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ANALYSIS OF THE CRISIS HOME ALERTING TECHNIQUE

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ANALYSIS OF THE
CRISIS HOME ALERTING TECHNIQUE

by

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30 January 1969

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ABSTRACT

This report presents the results of analyses made of the Crisis Home Alerting Technique (CHAT). The analyses involved studying the several possible modes of CHAT as they would apply to the major broadcasting media. The investigations centered on the following factors: homes covered, technical and operational problems, public acceptance, and cost.

The background and history of CHAT are described in the report as are the various modes of CHAT operation. Conclusions are presented relating to the most appropriate mode/media relationships and recommendations are given on implementation and further considerations necessary. Three appendices are included describing selection of stations, program materials, and station operations.

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SUMMARY REPORT

ANALYSIS OF THE CRISIS HOME ALERTING TECHNIQUE (CHAT)

BACKGROUND

The Crisis Home Alerting Technique (CHAT) proposes to use existing broadcasting facilities of the radio and television industries to alert and warn the public in the event of a crisis. In an increased readiness period, and upon appropriate governmental pronouncement, citizens would tune their home receivers to participating stations; at a specified time during the evening the stations will reduce broadcast modulation levels to approximately 10 to 20 percent for radio and to zero for television. Listeners would adjust the volume control of their home receivers to the highest level that does not prevent them from going to sleep. If it should become necessary to broadcast a warning, the broadcasting stations would increase the audio modulation level, thereby raising the home receiver's volume level to a point at which an alerting signal and warning message would awaken the sleepers.

PROJECT SCOPE

As a part of the Warning Research Program, SDC was requested to review CHAT and to develop plans and policies for CHAT implementation, criteria for station selection, and guidance for the preparation of program materials. During the course of the study, the CHAT modes were considered in relation to the primary media that would serve as the broadcasting source to the public. The factors considered in each analysis were: homes covered, operating costs and revenue loss, technical problems, and public acceptance.

SUMMARY OF CONCLUSIONS

- The analyses have indicated that CHAT offers a significant potential capability to provide alerting signals and warning messages to the urban population of the U.S. Most of the essential components of such an interim home warning system are in existence, with only implementation policy and procedures requiring further development.

- VHF television and AM radio have several advantages over UHF television and FM radio for use in CHAT. Using VHF television and AM radio, an alerting signal and warning message could reach the majority of U.S. urban area homes during the nighttime hours. Present home saturation is extremely high for these media, approaching 98% of all U.S. homes for AM radio and 94% for VHF television. Because of the coverage potential, further development and implementation steps should be geared primarily to these two media. However, there were no technical reasons uncovered during this study that would prevent UHF television and FM radio from being used as a part of a CHAT system.

- To a degree, the broadcasting medium dictate the specific mode of CHAT that should be chosen for use. Three of the CHAT modes appear particularly applicable to an interim CHAT system. The modes deemed most appropriate are Mode Two (Special Programming) and Mode Three (Special Signals) for radio, and Mode Four (No Audio Moculation) for television. These all have significant advantages over Mode One (Normal Programming) or Mode Five (Listener Watch).

- The major factors influencing the use of VHF television under Mode Four for CHAT operations are as follows:

  1) Detent tuning of VHF television allows for specific channel selection, thus not requiring an audible signal for tuning and adjusting set volume by the listener. The lack of an audible signal also allows for a quiet receiver during the sleeping hours, provided that the station continues to broadcast the frequency aural carrier; the lack of which causes an intercarrier hum (or "front-end noise") to be reproduced in many home receivers.

2) The awakening potential using VHF Television CHAT is considerable. Listeners may keep home set volume as high as the noise level will allow, thus assuring that when full audio modulation is restored, sound level increase in the home will be substantial.

3) Video-only information can be broadcast to provide current news or instructions and to assure viewers that the station is participating in CHAT.

4) A factor that might inhibit the use of VHF television is that only a few VHF television stations are presently on the air full time during the majority of the CHAT activation hours (11:00 PM to 7:00 AM). The study showed that only seven VHF stations presently maintain 24-hour operation, with the majority of the stations signing off in the 12:00 to 1:00 AM time period. For CHAT operations, this means that a number of stations would have to maintain limited studio and full transmitter operations throughout the CHAT period. To do so would necessitate additional operating costs on the part of the stations involved, and some potential loss of revenues, (between periods of 11:00 PM and normal sign off).

5) Cost estimates to maintain essential television studio technical personnel on duty, and to keep transmitters on the air were variously quoted as being from $225 to $450 per operating hour. It is likely that these estimates, obtained from technical personnel, do not fully cover all operating costs. If the indirect costs of operating a station were included, the combined hourly charges could possibly double. Potential loss of revenue to television stations varies widely within and between the various television market areas. The average hourly revenue loss, using figures from stations in the top 102 market areas, is $444. However, when revenue loss is calculated assuming three network stations each in the cities of New York, Chicago, and Los Angeles, the average is $2,078. Considering the actual time during which television stations would suffer revenue loss, the range for the top 102 market areas varies between $250 and $5,175 per program hour.

6) The total number of television stations required to provide service to the 213 urbanized areas is estimated not to exceed 150. Further study aimed at minimizing overlapping coverage might reduce this figure by 10 to 20 percent.

- The major factors influencing the use of AM radio for CHAT are as follows:

1) AM radio has a greater home coverage potential and somewhat greater dispersal and mobility within the home than VHF television.

2) There appear to be a sufficient number of nighttime radio stations on the air to provide coverage to the majority of U.S. urbanized areas during the 11:00 PM to 7:00 AM time period.

3) Choosing the appropriate CHAT mode for radio is more complex a problem than choosing the appropriate mode for television. Since most radio sets do not have fixed tuning, the absence of audio modulation would cause significant problems in station tuning and set volume adjustment for those tuning in after 11 PM. For AM radio CHAT, therefore, it will be desirable to use either Mode Two (Special Programming) or Mode Three (Special Signal), both of which operate at reduced modulation.

4) The analyses indicate that Mode Three (Special Signal) may constitute the best initial mode for this medium. Mode Three, which would employ a distinctive continuous signal, may provide the best service in an interim basis for radio.

5) The awakening potential of radio operating on reduced modulation is believed to be somewhat lower than that of television operating in CHAT Mode Four. This is due to the fact that the relative volume increase attainable from a radio set adjusted to pick up a 10-20 percent modulated signal will be less than the increase for a TV set adjusted for a zero modulated signal.

6) The actual capability for radio CHAT to awaken the sleeping public is not yet known, nor is the effect that even a low volume of audio may have on the ability to fall asleep.

7) Operating costs to maintain and operate AM radio studios and transmitters during the 11:00 PM to 7:00 AM period were not considered separately in the analysis, as these costs would be part of a station's revenue lost due to CHAT. The loss-of-revenue costs for a radio station to participate in the CHAT program, excluding that portion of lost revenue that could be recovered through make-ups of advertising, etc., range from a low of $20 to a high of $300 per 8-hour period. The upper limit in this case is undoubtedly the better, as it is computed from high-revenue stations in the major metropolitan areas.

SUMMARY OF GENERAL RECOMMENDATIONS

- Initially, CHAT should be extended over the VHF television and AM radio broadcast media--and on a first priority basis to the major metropolitan areas.

- Further development and implementation of CHAT should presume that CHAT will be an interim system, replaced by a positive control home warning system within five to ten years. Therefore, CHAT should be implemented as inexpensively as possible.

- A significant potential exists for the use of CHAT for alerting and warning of local, predictable disaster situations during the sleeping hours. Television and radio stations participating in CHAT should be encouraged to activate and operate the system during these periods. Aside from its life-saving potential, such use should make it possible to obtain better empirical data on the effectiveness of the CHAT modes and of the media employed, in terms of awakening ability, public and broadcaster acceptance, and technical problems.

- It is desirable to develop the operating doctrine and procedures for CHAT so as to allow for implementation to begin within a six-month period. Thus, the CHAT system should utilize only component elements that are currently in place and in operation.

- While it is recognized that the hours of CHAT will not suit all of the potential listeners, the assumption that CHAT should be in effect on radio and television during the period from 11 PM to 7 AM, local time, seems to provide the most efficient method of operation and should be considered as a basis for initial planning.

- A distinctive CHAT alerting signal and warning message are recommended for use in the initial system. They are described in Appendix B of the report.

- It is recommended that the primary means for disseminating CHAT messages should be through the Emergency Action Notification System (EANS), which uses the facilities of the AP and UPI wire networks. NAWAS on a day-to-day basis is used too extensively to be useful for direct application to CHAT stations. Its usefulness as a primary CHAT message source is restricted in that it does not presently terminate at radio broadcast stations, does not go into every town that has a radio or television station, and does not provide hard copy messages.

FUTURE CONSIDERATIONS

- The overall relationship of CHAT to the Emergency Broadcast System should be considered in more detail. CHAT may be activated well in advance of an attack; it may be activated on an on-again off-again basis but never be operationally utilized; it could be activated with a large number of non EBS radio and television stations participating, and it could be activated by a different source than EBS. These possibilities indicate that CHAT has a number of variations that may be incompatible with, or at least are not closely related to, current EBS planning.

- The actual costs of CHAT operation to participating stations should be investigated in terms of: amortization of capital, insurance, taxes, retirement, and other payroll burden and overhead. The procedures for implementing the program should be viewed within the cost-context insofar as broadcast industry willingness to participate is likely to vary with incurred expenses. Other alternatives to voluntary participation by the broadcasters should also be explored, e.g., shared-cost with government, tax relief for lost revenues, etc.

- A study of the merits of the special signal versus the special programming modes should be performed in the future.

- The extent to which NAWAS should be used as a backup or secondary source of warning information for stations participating in CHAT should be considered.

- A determination should be made of how local outdoor warning systems activation can best be effectively timed to coincide with and to complement CHAT alerting and warning operation.

- It should be determined whether broadcasting stations would be willing to use, and whether they should be allowed the option of using, pretaped alerting signals and warning messages.

- Studies should be made of the significance of loss of secondary coverage and the effects on listener acceptance brought on by adjacent and co-channel interference when CHAT stations are operating with lowered modulation.

- Further study should be made of the awakening potential of increases in modulation using the special alerting signal and of the specific effects of various kinds of reduced modulation modes on persons trying to get to sleep.

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INTRODUCTION

I. PURPOSE AND SCOPE

In January 1967 SDC was requested to include, as a part of its Warning Research Program (Work Unit 2212E), a review of the Crisis Home Alerting Technique (CHAT) and to develop implementation plans, policies, and criteria for station selection, program materials, and station operations. A draft final report[1] on this project was issued in September 1967.

In October 1967 a nationwide training exercise (CDEX 67) was conducted. An OCD analysis of the results of CDEX 67 indicated that increased warning effectiveness, brought about through the interim implementation of an indoor home alerting technique, was necessary and desirable.

As a result, SDC was asked in April 1968 to reexamine the previous draft study in light of the CDEX 67 results and implications, and to consider the problems associated with implementing CHAT as an expedient interim system.

II. ORGANIZATION OF REPORT

This report presents the results of both the earlier CHAT review and the more recent analysis. Chapter One reviews the history of CHAT and presents the primary assumptions governing the intensified analysis. Chapter Two presents conclusions and recommendations derived from the analysis. Chapter Three describes that analysis, and presents the results in terms of the primary factors considered, i.e., homes covered operating costs, technical problems, and public acceptance.

Appendices to this report deal with CHAT programming, station selection, and station operations; in the main, the appended material is derived from the earlier draft study.

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1. SDC TM-L-3390/005/00, Crisis Home Alert Technique (CHAT) Development Project: Final Report (Draft), September 29, 1967.

CHAPTER ONE

BACKGROUND AND ASSUMPTIONS

I. CONCEPT OF CHAT

The Crisis Home Alerting Technique (CHAT) proposes to use existing broadcasting facilities to alert and warn the public in the event of a crisis. Citizens wishing to take advantage of CHAT will tune their home receivers to a participating station, and at a specified time the station will reduce modulation to approximately 10 to 20 percent. Listeners will adjust the volume control of their receiving sets to a level at which the sound does not prevent them from going to sleep. If a change in the situation warrants, the broadcast station will increase the level at which it is modulating its audio signal so as to raise the home receiver's volume level to a point where an alerting signal and warning message will awaken the sleepers.

II. HISTORY OF CHAT

A document describing the CHAT concept in greater detail is quoted in full on pp. 14-15.[1] At the time that this document was written (January 1965), it was expected that routine programming would continue at reduced modulation levels 24 hours per day throughout the crisis period. Also, no provisions were made at that time for including the facilities of the television industry.

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1. Crisis Home Alerting Technique (CHAT): A Radio Broadcast Alert Technique for a Strategic Alert Period, (unidentified memorandum in OCD File), 14 January 1965.

CRISIS HOME ALERTING TECHNIQUE

Purpose: To use the existing facilities for radio broadcasting as a means of public alerting during periods of strategic warning or impending crisis, including subsequent tactical or local disaster warning.

Background: All home alerting system proposals founder on the twin rocks of receiver cost (initial, distribution, installation, maintenance) and coverage (public acceptance, distribution, actual use, maintenance, performance). The OCD is actively working to surmount this obstacle. Numerous possibilities present themselves, and a feasible solution may be achievable in the next 3 to 10 years. Meanwhile, there is no home alerting system in being.

The vast capabilities of the U.S. broadcasting industry, and specifically, in some cases, the EBS and its initiation means, the EAN, offer a capability for adopting an interim alert technique which, while it does not convert EBS into a warning system, can take advantage of the drawing power of one key feature of the EBS, i.e., the President of the United States and the attention any pronouncement by him will command in a crisis period. This alerting technique (CHAT) was given a preliminary tryout during an intensive radio systems analysis by OCD in late 1963 and early 1964; within recognized limits its tactical feasibility appears assured.

General Principle of Operations: If a broadcast station is operated at a relatively low level of audio modulation during a period of international tension (strategic warning) the broadcast receiver, when turned on in the home, serves as an alarm receiver operating with its volume control advanced, yet quietly enough (because of the reduced station modulation) to permit sleeping and other normal home occupancy during the strategic period. Should a tactical warning be received or other urgent messages arrive, the broadcast station would transmit an attention signal at full modulation, so as to provide a louder-than-normal signal in the home. This would be followed by the appropriate emergency information, also at full modulation.

Sequence of Events: (Note that the following scenario statements are merely typical of what might be done.)

Given an international crisis of the type which prompts Presidential messages (e.g., Cuba 1962), CHAT activation is decided upon. The President makes his speech (EBS may or may not have been activated) and at the proper moment advises the audience as follows: "In a moment my voice will begin to fade; merely turn your volume up until you can hear me again. This is part of a system which will permit you

to receive later emergency information. Please leave your receivers on constantly; when you wish to sleep, turn the volume down to a comfortable level, and I will be able to reach you by means of your radios and televisions." (Stations in EBS which are not served by networks can present similar instructions by their local announcers.) At this point, all stations reduce their modulation (to say 20%). Thereafter, any tactical warning or other urgent message can be conveyed to the public via EAN-EBS by upping the modulation (to 80%-100%), sounding an attention-getting tone (even the present 1000 cps will do), and delivering the message.

(Note that this is not a survivable system, and it is not at all useful to warn of sudden enemy action unless a build-up of tension preceded the attack.)

Broadcast Station Requirements: The broadcaster would provide (1) 24-hour operation in as many cases as feasible, (2) the prescribed attention signal, and (3) a means to control the level of audio modulation.

Requirements in the Home: As each person learns, through radio, newspapers, or word-of-mouth, of the threat to the Nation or to his area, he turns on (or continues to listen to) his radio or TV, turning the volume control up to compensate for the reduced modulation at the station, thereby restoring the audio of his receiver to its normal level.

When he wishes to operate the radio on standby so that he may go about his home activities, including sleep, he reduces the audio volume to a point where he can live with it. If the attention signal is subsequently transmitted, it will now come through the receiver with increased volume so as to awaken him or get his attention from a distance.

System Compatibility: CHAT is compatible:

1. With all known methods of radio warning. Thus, it would neither interfere with a subsequent radio warning program nor be effort or money lost if radio warning were adopted.

2. With EBS, since it uses the EAN and does not change EBS operational modes.

3. With normal broadcasting, since only a simple and familiar adjustment of audio volume is needed.

As a result of this report, in February 1965, OCD directed that a committee composed of representatives of the OCD Directorates of Technical Services, Plans and Operations, and Research be formed for the purpose of further

investigating the feasibility of CHAT. This Ad Hoc Committee on CHAT produced several interim documents and a final report incorporating the views of each representative. Several points were developed in these reports: that an overall improvement in warning coverage, encompassing 30-75 percent of the population, could result from nationwide implementation of CHAT;[1] that the program could be implemented in a manner similar to the shelter identification program through the joint efforts of OCD, OCD contractors, Federal Communications Commission (FCC) and the National Industrial Advisory Commission (NIAC);[2] and that employment of television facilities would have distinct advantages over standard AM or FM radio.[3]

A number of significant problem areas were also pointed out in the committee reports, specifically:

- the need to field test the effectiveness of the technique for awakening sleepers
- the need for accurate information on broadcast station operations and on the effects that reduced modulation would have on population coverage
- the need for a more comprehensive analysis of the administrative, commercial, and legal implications of CHAT.[4]

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1. Brown, Henry M., Some Observations as to the Population Coverage Afforded by CHAT with Standard AM Radio. (Unnumbered memorandum in OCD file), 8 February 1965, p. 6.

2. A Program for CHAT (Draft), (Unnumbered memorandum in OCD file), 12 February 1965, p. 11.

3. Martin, Robert B., Recommendation for Report (Number Three), Memorandum to Mr. Henry M. Brown, Chairman, Ad Hoc Committee on CHAT, from Mr. Robert B. Martin, Staff Director, Communications-Electronics Division, OCD, 16 February 1965.

4. CHAT: Assumptions, State-of-Knowledge, and Factors Requiring Investigation, (Unidentified memorandum in OCD file), 18 February 1965, pp. 3-5.

The Committee's final report judged CHAT to be: (1) suitable for additional research, (2) ready for preliminary testing, but (3) not ready for implementation.[1]

Two preliminary tests of the CHAT concept, using the facilities of WBAL-AM, Baltimore, were conducted with the cooperation of John Wilner, Vice President in charge of Engineering for the Hearst Corporation and Chairman of the CHAT Subcommittee of NIAC. Both tests were limited in approximating CHAT operational conditions because WBAL-AM broadcasts at reduced power during the night and stations on the same and adjacent channels, using full power, created interference in many areas. Also, the first test (conducted 21 March 1966) was not an optimal representation of CHAT use during a crisis period because some station testing was done during the period of reduced modulation. The second test (conducted on 18 July 1966) was closer to approximating ideal programming conditions but had fewer participating subjects (23 as versus 90 in the earlier test). The results of the second test were, however, quite encouraging; 50 to 75 percent of the subjects were awakened by the alert signal broadcast at 100 percent modulation.[2]

III. CHAT IMPLEMENTATION OBJECTIVES AND OPERATING REQUIREMENTS

The major assumptions about CHAT, which were used in this analysis, are outlined below. These assumptions have had a significant governing influence on the analysis, and an awareness of them is essential to a proper understanding of the report. It should be emphasized that the assumptions were intended to provide an initial frame of reference.

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1. Committee Recommendations Regarding CHAT, Ad Hoc Committee on CHAT, Unnumbered Memorandum, 18 February 1965.

2. Kerr, James W., Letter to John Wilner, 14 November 1966.

- CHAT should be considered as providing an interim home alerting and warning capability. Limitations on the effectiveness of CHAT preclude its being considered as the only long-range answer to home alerting and warning. The major limitation of CHAT is the lack of positive control for all components beyond the notification system. Public participation is assumed, but there is no way of ensuring that home receivers are correctly tuned, adjusted, or even turned on. This suggests that a warning system, operated and controlled by a single agency, provides the possibility of a higher return in lives saved through assured, positive controlled warning.

- CHAT should be applicable to all the major broadcast media. If CHAT is to prove useful to the public, it should operate through stations broadcasting on frequencies normally used for public reception. Participation in the CHAT program will be by the usual AM and FM radio, VHF television, and some Ultra-High Frequency (UHF) television, depending on the distribution of receivers in an area and on some unique characteristics of the geography. The CHAT techniques employed to alert and warn the sleeping population should be usable by any or all of these media.

- CHAT should be capable of implementation within six months. In light of the CDEX-67 analysis, it appears desirable to develop a feasible implementation plan for an expedient home alerting and warning system. Since the system will make maximum use of "in-place" components and capabilities, such a warning system can be achieved in a relatively short time. A period of six months is estimated to be a practicable time-span within which to implement the system.

- CHAT should be implemented on a basis as nearly cost-free as possible. A desirable goal for CHAT is to maximize the use of those portions of the broadcast system presently available. Undoubtedly, there will be some costs associated with any implementation scheme; however, selecting "in-place" components of the broadcasting system without sacrificing coverage or capability should hold costs to a minimum, although at this time the dollar value of that minimum cost is uncertain.

- The hours of operational activation for CHAT should be between 11:00 PM and 7:00 AM. For the purpose of this analysis, the assumption was made that CHAT would be activated only during the sleeping hours. Recognizing that it will be impossible to satisfy all users of CHAT with respect to the hours of activation and for purposes of the discussion in this report, an activation time of 11:00 PM local time has been established. While arbitrary, this choice presents a basis from which a number of factors, e.g., cost and public acceptance, can be examined. CHAT phase-out at 7:00 AM would coincide closely with the awakening of many persons. A system of staggered hours for different stations serving a given community appears to be a cumbersome procedure to implement on a national scale. While it would be theoretically possible to reduce participating station (or all stations) modulation for 24 h a day during crisis, it was determined that this procedure should not be followed because:

  - The unknowns of crisis duration, coupled with possible loss of advertising revenues, would make this particular procedure less desirable from the point of view of the broadcasting industry.

  - To an unspecified degree, it might reduce station secondary coverage and overall capability.

  - Many among the daytime audience will not require the increased modulation feature, and an unknown but probably significant portion of the total population does not have ready direct access to the broadcast media during working hours.

- CHAT should provide alerting and warning for localized natural disasters about which predictions can be made. In order that the benefits of the Crisis Home Alerting Technique may apply to as many situations as possible,

CHAT should not be limited to activation only during national emergencies. Predictable natural disasters--hurricanes, tornadoes and tsunamis--may all occur at night and often are preceded by enough warning time so that a local or regional application of the technique could be put into action before normal sleeping hours. In some cases these applications may be limited to local television stations or FM stations owing to interference in AM radio transmission by atmospheric conditions (and also as a means of restricting coverage to the affected areas). However, these reasons should not limit the overall usefulness of CHAT as a local natural disaster alerting and warning system.

- CHAT should not require special stations, facilities, or transmitters. Given the large number of existing broadcasting facilities in the United States, adequate coverage should be easily and readily achieved without any special installations. Stations participating in CHAT may normally be operated as a commercial enterprise by the state, an educational institution, or a community.

- CHAT should be compatible with existing warning systems and disaster plans. The systems most likely to interface with CHAT are the Emergency Broadcast System (EBS), the National Attack Warning System (NAWAS), and local Civil Defense warning plans. It appears likely that all of these systems are capable of interacting with a nighttime-only alerting and warning technique.

- CHAT implementation should not necessitate major revisions to Federal Communications Commission (FCC) regulations concerning broadcast stations. The fact that CHAT will be used only during periods of severe crisis should provide justification for limited waivers of necessary regulations. It is assumed that the FCC would waive or modify the appropriate rules regarding modulation levels, so that the implementation of CHAT will not cause revisions of established policy and procedures.

- CHAT operations should be generally controlled by one agency. Even though the organization, and implementation of CHAT may require participation from several government agencies as well as the broadcasting industry, it seems clear that for coordinating purposes the operational phase should be under the control of a single agency. This control will begin following the presidential-level decision to activate CHAT and will continue through the dissemination of the activation message (and all other communications) until the crisis has terminated. It is desirable, however, to allow a certain amount of local option and to provide special procedures to use local broadcast facilities for purposes of providing natural disaster warnings.

IV. MODES OF CHAT OPERATION

Previous descriptions of CHAT have distinguished five modes of operation.[1] In this analysis, we assume that at least one (or some combination) of these modes would be in effect during the nighttime hours of a strategic period. Chapter Three of this report will deal with an analysis of the effectiveness of each of these modes in terms of operating costs, technical problems, and public acceptance. This section will briefly describe each of the CHAT modes.

Mode One - Normal Program Content at Low-Level Modulation

This mode entails the use of normal programming material at the broadcasting station under conditions of reduced modulation. No changes are anticipated in the kinds of broadcasts and the mode can be applied in the same way to both radio and television. Prior to activation of CHAT, probably around 11:00 PM, station personnel would make the appropriate announcements about adjusting the

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1. CHAT: Assumptions, State of Knowledge, and Factors Requiring Investigation, OCD unnumbered paper, 18 February 1965.

volume of home receivers and then would reduce the modulation level at the broadcasting facilities. There would be no interruptions or changes in materials being programmed or commercial messages. Frequent announcements would be made to indicate that the station was participating in CHAT, but the public would not be able to tell, from the nature of the program material alone, that CHAT was in effect. Fully modulated broadcasting would resume at about 7:00 AM, perhaps preceded by gradual increases in modulation over a 5 to 10 minute period so as not to startle listeners.

Mode Two - Special Programming at Low-Level Modulation

This mode is similar to Mode One in terms of modulation changes but differs in that the type of programming is designed to be unobtrusive. In Mode Two CHAT, following the station announcements and reduction of modulation, the programming would be specially selected, e.g., soft music, to be soporofic in nature. This is to increase the likelihood of people going to sleep and remaining asleep unless a special alerting signal and warning message were used to awaken them. Under this mode, commercial announcements would be withdrawn, and the only announcements made would be those of station identification and those describing the station's participation in the CHAT program. Normal commercial programming would return in the morning hours, following the increase in modulation.

Mode Three - Special Signal

This mode eliminates all requirements for normal or special programming and instead provides a special kind of signal, e.g., a ticking clock, metronome, or steady tone, again at low-level modulation. The signal would be selected so as not to interfere with sleep but would indicate that the set was properly tuned to a participating CHAT station. During the hours of CHAT operation, the only other programming would be station identification.[1]

1. The effects of a steady signal or tone on a population attempting to get to sleep or of interrupting such a signal while people are sleeping for purposes of verbal station identification are not known.

Mode Four - Carrier Only--No Audio Modulation

This mode of operation is particularly suited to use with detent-tuned receivers, and is therefore applicable to VHF television. In this mode, the audio carrier would be maintained but audio modulation would be reduced to zero. Video programming of a special nature could continue, providing viewers with assurance that the station was on the air, and also providing instructions and information. Viewers would be instructed to turn the receiver volume as high as noise level would permit before retiring for the evening. Should an emergency situation develop, the station would return to normal full audio modulation, broadcasting appropriate alerting signals and warning messages. Normal broadcasting would resume in the morning hours, with modulation gradually increasing over a short period of time.

Mode Five - Listener Watch

This mode was not part of the original CHAT concept, since it does not require any modulation change at the broadcast facility. The basic requirements of this mode are that the participating stations be on the air during the time period, and that they be able and willing to receive and broadcast alerting signals and warning messages. A further necessity is that some segment of the public be willing to stay awake during the hours of operation to listen for warning messages. This mode assumes that the public would organize by families or small groups to assume some kind of shift operation, thus allowing some members of the family or group to sleep.

V. PHASES OF CHAT

Once the decision to adopt the CHAT program has been made, four subsequent sequential phases of CHAT activity can be identified. An understanding of these activities and of what is included in the four phases of CHAT will be useful for a more complete and comprehensive understanding of this report.

Phase 1 - Development - This phase is characterized by the preparation of plans for operation and implementation. It includes formalizing the system concept of operations, determining the precise number and location of stations required to effect the desired population saturation, developing appropriate procedures for the activation and utilization phases, and preparing materials required for successful implementation.

Phase 2 - Implementation - This phase is characterized by the installation of the developed program as a part of the Emergency Broadcast System at each of the participating stations. Inasmuch as CHAT will be using various component elements of the existing wire networks and broadcast industry, the principal installation function is procedural in nature, accompanied by appropriate familiarization and testing procedures.

Phase 3 - Activation - Until an emergency arises, CHAT will be passive in nature. It will exist in the minds and manuals of the users as a set of procedures to follow in the event of a crisis. Activation of CHAT will be accomplished by an activation order from some level of government; this order will presumably put the system into simultaneous operation throughout the country. If CHAT were ever activated, the public would be notified that CHAT would be in effect during the nighttime hours, and at the prescribed time, all participating stations would decrease modulation and notify listeners as to the procedures they should follow.

Phase 4 - Utilization - This phase of CHAT is the basis for the system's existence. CHAT would be used to broadcast, at full modulation, an alerting signal and warning message to awaken and notify the public. It is presumed that the alerting signal would be generated at the broadcast studio after receipt of a properly authorized and authenticated warning message. The broadcast message might be a prepared one (stored at the station for this use) or might be the contents of a hard-copy message received over a wire network.

CHAPTER TWO

CONCLUSIONS AND RECOMMENDATIONS

I. SUMMARY

This Chapter discusses the basic conclusions derived from the CHAT analysis. In it operating requirements that provide implementing guidance for CHAT will be discussed, as well as the kinds and extent of further developmental work required.

The two CHAT analyses conducted by SDC over the past 18 months have shown that the CHAT concept offers a significant potential capability to provide alerting signals and warning messages to the population of the U.S. All of the essential components of such an interim home warning system are in existence, with only policy and procedures left for development.

VHF television and AM radio have a number of advantages over UHF television and FM radio for use in CHAT. Through these two media, an alerting signal and warning message could reach the majority of U.S. homes. Because of their widespread coverage, they should both be used in an operational CHAT setting. The specific CHAT mode to be used will vary depending on the broadcast medium (radio or TV).

II. THE MODES OF CHAT

To a degree, the broadcasting media used will dictate the specific mode of CHAT that should be chosen. As discussed in the body of the report, five modes of CHAT were considered. Of these modes, three appear applicable to an interim CHAT system. The CHAT modes deemed most appropriate as a result of this analysis effort are Mode Two (Special Programming), Mode Three (Special Signals) and Mode Four (No Audio Modulation). These all have significant advantages over Mode One (Normal Programming) or Mode Five (Listener Watch).

III. THE MEDIA FOR CHAT

All of the standard broadcasting media, i.e., AM and FM radio, UHF and VHF television, have potential for CHAT. Present home saturation is extremely high in the cases of AM radio and VHF television, approaching 98% for radio and 94% for VHF television. Because of the coverage factors, and because we understand CHAT to be an expedient and interim system, further development and implementation steps should be geared primarily to these two media. However, there were no technical reasons uncovered during this study that would prevent UHF television and FM radio from being used as a part of a CHAT system.

During the course of the study, each of the five modes of CHAT was considered in relation to each of the four media that might serve as the broadcasting source to the public. The primary factors considered in each analysis were: homes covered; operating costs and revenue loss; technical problems; and public acceptance.

A. VHF Television CHAT

Mode Four--CHAT (No Audio Modulation) has definite advantages over any of the other modes for use in VHF television for the following reasons:

1. Detent tuning of VHF television allows for specific channel selection, thus not requiring the listener to have an audio signal for purposes of tuning and adjusting set volume.

2. The awakening potential is considerable in VHF Television CHAT; listeners may keep home set volume as high as noise level will allow, thus assuring that when audio modulation is restored, sound level increase in the home will be substantial.

3. Video information can be broadcast both to provide current news and to assure viewers that the station is participating.

4. The use of this mode allows a quiet receiver during the sleeping hours.

A significant constraint in the use of VHF television for CHAT lies in the fact that only a very few VHF television stations are on the air full time during the majority of the CHAT activation hours (11:00 PM to 7:00 AM). The data used in this study showed that only seven VHF stations presently maintain 24-hour operation, with the majority of the stations signing off in the 12:00 to 2:00 AM time period. For CHAT operations, this means that some number of these stations would have to maintain limited studio and full transmitter operations throughout the CHAT period.[1] To do so would necessitate additional operating costs on the part of the stations involved, some potential loss of revenues, (between periods of 11:00 PM and normal sign off), and some modification or waivers of licensing restrictions.[2]

B. Radio CHAT

Radio has a greater home coverage potential and somewhat greater mobility within the home than VHF television. Radio also has the advantage of being better known as an immediate source for current events and news. There appear to be a sufficient number of nighttime AM radio stations on the air to provide coverage to the majority of U.S. population centers during the 11:00 PM to 7:00 AM time period.

Choosing the appropriate CHAT mode for radio is more complex than choosing the appropriate mode for television. If the only factor considered were listener appeal, Mode Four (No Audio Modulation) would be best since it allows the user to sleep with no sound coming from his receiver. Unfortunately,

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1. Estimates of precise number of stations required vary. One estimate from a survey of Television Factbook data indicates that approximately 150 stations could provide minimal coverage of the 213 market areas.

2. The actual costs of operating CHAT should be carefully investigated and an analysis of the implementation problems performed in a future study.

since most radio sets do not have fixed tuning, the absence of audio modulation would cause significant problems in station tuning and set volume adjustment. Therefore, for both AM and FM radio, it will be necessary to use either Mode Two (Special Programming) or Mode Three (Special Signals), both operating at a reduced modulation level. The results of the analysis indicate that Mode Three (Special Signal), because of its distinctive CHAT signal, may constitute the best initial implementing mode for this medium. The special signal would be easy to find and identify if the user tuned in later and it could even be made soporific if carefully tested in advance. The awakening potential of radio operating on reduced modulation is believed to be somewhat lower than that of television operating in CHAT Mode Four. This is due to the fact that the relative volume increase attainable from a radio set adjusted to pick up a demodulated signal will be less than the increase for a TV set adjusted for a zero modulated signal. Of course, the actual capability for radio CHAT to awaken the sleeping public is not yet known. Also unknown is the effect that even a low volume of audio may have on the ability to fall asleep. Both of these areas require further study, using as a starting point the previous WBAL tests.

IV. PROCEDURAL AND TECHNICAL PROBLEMS OF CHAT IMPLEMENTATION AND OPERATIONS

Technical implementation and operating problems associated with CHAT in both the radio and television media appear to be few. Most radio and television station personnel contacted during this study indicated that the capability exists to lower modulation (although some deterioration of coverage may occur). In television CHAT, there are no major technical problems associated with zero modulation as long as the audio carrier is on. As always, the problems found were associated with station cost of operation through lost revenues and lowered audience ratings.

For both radio and television, it will be necessary to provide the participating stations with sufficient and properly verified information regarding the presence

of a threat to allow for activation and operation of the system. The primary means for disseminating CHAT messages should be through the Emergency Action Notification system (EANS) and the facilities of the AP and UPI wire networks, possibly using NAWAS as a backup. NAWAS on a day-to-day basis is used too extensively to be useful for direct application to CHAT stations. In addition, NAWAS usefulness as a primary CHAT message source is restricted in that it does not presently terminate at radio broadcast stations, does not go into every town that has a radio station, and does not provide hard copy messages.

There are a number of policy and procedural areas that need clarification prior to CHAT implementation. In brief:

- The overall relationship of CHAT to the Emergency Broadcast System should be considered in more detail. CHAT may be activated well in advance of an attack; it may be activated on an on-again off-again basis but never be operationally utilized; it could be activated with a large number of radio as well as television stations participating. These possibilities indicate that CHAT has a number of variations that may be incompatible with, or at least are not closely related to, current EBS planning. EBS plans would have to be modified to include procedures and authorities applicable to CHAT, and FCC policy should encourage qualified stations to volunteer as participants.

- Revisions to EAN System operation and procedures are required to provide CHAT stations with properly authenticated system activation and warning messages. For example, message formats for the CHAT activation message would have to be generated.

- The extent to which NAWAS should be used as a source of warning information for stations participating in CHAT should be critically considered.

- It must be determined how the local outdoor warning system activation can best be effectively timed to coincide with and to complement CHAT alerting and warning operations.

- It must be determined whether broadcasting stations would be willing to use, and whether they should be allowed the option of using, pretaped alerting signals and warning messages. Perhaps they should act only in a relay capacity, broadcasting the contents of the hard-copy data received over the wire networks.

- The problem of costs for CHAT operation and how they should be borne, and by whom, is recommended for further study.

V. OPERATING AND LOSS OF REVENUE COSTS

The costs associated with the operation of CHAT fall into two primary categories: those of maintaining selected stations on the air during the hours of CHAT operation, and revenue losses that may occur over time as a function of programming modifications required for CHAT operation.

A. Radio Costs

For radio, the direct costs to maintain and operate studios and transmitters during the 11:00 PM to 7:00 AM period are probably quite modest when compared to the indirect costs and to the lost revenues. In the body of this report, revenue losses for stations and operating costs are roughly estimated from FCC figures. For the purposes of this summarization, and because we are primarily concerned with coverage for the larger metropolitan areas, we have used the upper limits of these cost data. The obtaining of specific operating costs for stations is a difficult and sensitive task. The loss-of-revenue costs for a radio station to participate in the CHAT program, including that portion of lost revenue that could be picked up through makeups of advertising, etc., range from a low of $20 to a high of $300 per 8-hour period. The upper limit in this case is undoubtedly the better, as it is computed from high-revenue stations in the major metropolitan areas.

B. Television Costs

Operating costs to maintain studios and transmitters on the air for television range from a low of $225 to a high of $450 per operating hour. Potential loss of revenue to television stations varies widely within and between the various areas. The average hourly revenue loss, using the averages of the stations in the top 102 market areas, is $444. Using three network stations each in the cities of New York, Chicago, and Los Angeles, the average is $2,078. Considering the actual time during which television stations would suffer revenue loss, the range for the top 100 market areas varies between $250 and $5,175 per program hour.

VI. IMPLEMENTING GUIDANCE

Certain of the basic assumptions which were used in this analysis, and operating criteria determined as a result of the study, should be considered for use in policy and implementation guidance. The more important of these are briefly enumerated below. Additional discussion of these points can be found in the body and appendices of the document.

- Initially, CHAT should be extended over the major AM radio and VHF television broadcast media--and on a first priority basis to the major metropolitan areas.

- Further development and implementation of CHAT should presume that CHAT will be an interim system, replaced by a home radio warning system within five to ten years. Therefore, CHAT should be implemented as inexpensively as possible.

- A significant potential exists for the use of CHAT for alerting and warning of local, predictable disaster situations during the sleeping hours. Radio and television stations participating in CHAT should be encouraged to activate and operate the system during these periods.

Aside from its life-saving potential, such use should make it possible to obtain better empirical data on the effectiveness of the CHAT modes and of the media employed in terms of awakening ability, public and broadcaster acceptance, and technical problems.

- It is desirable to develop the operating doctrine and procedures for CHAT so as to allow for implementation to begin within a six-month period. Thus, the CHAT system should utilize only component elements that are currently in place and in operation.

- While it is recognized that the hours of CHAT will not suit all of the potential listeners, the assumption that CHAT should be in effect on radio and television during the period from 11 PM to 7 AM, local time, seems to provide a reasonable period of operation and should be considered as a basis for planning.

- A distinctive CHAT alerting signal and an eight part, 43-word warning message are recommended for use in the initial system. They are described in Appendix B.

- As noted earlier, it would be desirable to further study costs associated with the operation of radio and television stations under CHAT.

CHAPTER THREE

THE ANALYTICAL FRAMEWORK

I. INTRODUCTION

This section describes the analysis conducted by SDC on CHAT operations. It compares and evaluates the adequacy of the various CHAT modes and the several broadcast media that might be employed in the operational use of CHAT.

Table 1 depicts the general analytical framework used. The subsequent paragraphs describe in more detail the components of the analysis. It should be emphasized that this analysis was entirely governed by the assumptions stated earlier. In the analysis, the factors of population coverage, technical implementation and operational considerations, public resistance and costs of operation were considered in relationship to the modes of operation and to the media available.

In addition, to the extent that they were known, the particular operating characteristics of each CHAT mode were examined relative to each of the four media. This was done to determine peculiar operating or programming characteristics that might have an influence on a given medium's capability for use in association with any of the five modes being considered.

To some degree, because of a lack of empirical data, certain of the factors considered in the CHAT analyses are subjective estimates of the significance of influence a particular CHAT mode will have. This is particularly true in the area of determining public acceptance of the CHAT concept, especially in the sleep inducing, maintaining and arousal potentials of modulation changes as they affect acceptance. Also still largely unknown at this time, owing to lack of research, are the relative merits of using special programming over special signals as a distinctive CHAT mode.

TABLE 1

CHAT Analytical Framework

CHAT MODE	MODULATION LEVEL	BROADCAST MEDIA			
		AM	FM	VHF	UHF
1. NORMAL PROGRAMMING	10 - 20%				
2. SPECIAL PROGRAMMING	10 - 20%	HOMES COVERED TECHNICAL PROBLEMS PUBLIC ACCEPTANCE OPERATING COSTS			
3. SPECIAL SIGNAL	10 - 20%				
4. AUDIO CARRIER	0				
5. LISTENER WATCH	NORMAL				

For certain of the factors analyzed, a quantity of substantive data was available. For example, data were available on the potential coverage or population saturation potentials of the various media. In the area of radio and television operating costs, some quantitative data were available through various publications; however, obtaining the costs of specific items and reliable operating cost data for radio and television stations was difficult. Data were obtained on technical problems from interviews and discussions held with broadcast station technical and operating personnel.

The adequacy of a particular CHAT mode for utilization on any one of the broadcast media is significantly influenced by the characteristics of the medium, or by numbers and operating characteristics of the home receivers. For this reason, the analysis was organized around a discussion and consideration of the factors having the greatest influence on the mode/media relationship: homes covered, technical problems, public acceptance and operating costs. Each of these factors is considered and discussed independently. A summary is then presented that sets forth significant advantages and disadvantages relative to CHAT operation.

II. COVERAGE

Coverage of the four media as applied to CHAT operations was considered from several aspects--numbers of broadcast radio and television stations, numbers of stations on the air during the period, numbers of radio and television receivers, numbers of homes reached, and total population reached. While it appears that the most significant of these aspects for the purposes of CHAT will be homes and population reached, the other aspects are also of interest. Some data on these factors are presented below.

TABLE 2
Coverage Data[1]

COVERAGE FACTORS	TELEVISION					RADIO		
	VHF COML	VHF ETV	UHF COML	UHF ETV	TOTAL	AM	FM	TOTAL
STATIONS	499	75	136	75	785	4,190	2,124	6,314
SETS					78,200,000			213,600,000[2]
SET PRODUCTION					10,881,058			21,698,000[3]

1. Television Factbook; Services Volume: 1968-69 Edition, No. 38, Television Digest, Inc., Washington, D.C., pp. 57a - 59a.

2. Does not include 68,500,000 sets in automobiles.

3. Produced in U.S. only.

The vast majority of the U.S. is served by either radio or television and most homes have receivers. The statistical data indicate that radio provides the greater potential population coverage. Several reasons contribute to this:

1. Overall, there are more working radio sets of one sort or another in the United States than there are people. Including imports, over 31 million new sets were sold in 1967.

2. A radio receiver is a listening-only device, thus allowing the listener to participate in other activities while listening.

3. Radio is more mobile than television. The newer transistorized portable sets are often seen being carried by people of all ages in many public places.

The National Association of Broadcasters Radio Ownership Study conducted in 1966 indicated that of the total radio ownership population:[1]

79% have more than one radio

22% have 4 or more radios

55% have transistor radios

48% have FM radios

In terms of location of radio sets, the same study indicates:

62% keep a radio in the bedroom

41% have a radio in the front room

16% have a radio in the den, study, or basement

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1. Broadcasting, May 29, 1967, p. 36.

The number of homes reached by the radio and television media is estimated slightly differently by various rating services. For purposes of this discussion, data obtained from the American Research Bureau will be used.[1]

TABLE 3
Radio Television Coverage

Media	Homes (million)	% of All Homes	Home[2] Population Served (million)
Radio	57.3	98	189
Television	54.9	94	185

Television is considered primarily as a "viewing" medium. To an unknown degree, and depending upon the situation, it may represent a more valid source for information in allowing the recipient the use of two of his senses in the process of obtaining information and making a judgment about the validity of that information.

Television is less mobile than is radio, and there are fewer second sets. NBC Research estimates indicated that there were 1 ,170,000 secondary television sets located in homes in 1967,[3] in contrast to the radio ownership figures cited above, which showed that over 70% of the radio-equipped homes have more than one set (a greater initial population) and that 62% of radio-equipped homes already have a radio in the bedroom.

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1. Broadcasting Yearbook, 1967, p. 18.

2. Uses 3.3 persons per household--per 200 million Americans; U.S. Dept. of Commerce, Bureau of the Census, November 1967.

3. TV Factbook, p. 57a.

Another consideration, which will have some bearing on the population coverage factor, is the existing or present broadcasting status of radio versus television during the assumed hours of CHAT operation.

So far, we have been discussing potential population coverage, that is, coverage that could be obtained based on coverage patterns of stations and on the presence of broadcast receivers in the home. Another facet of the overall problem is the cost associated with CHAT broadcasts during the normal hours of station operation. CHAT, according to the assumptions we are following, is designed for nighttime operation--between the hours of 11:00 PM and 7:00 AM. In reviewing television station coverage necessary to provide saturation of the major urban areas within the limits specified for Grade A & B coverage, we found that only seven TV stations are scheduled to be on the air 24 hours a day; a fact which indicates that most stations will not lose revenues for the entire period.

This factor will have a significant effect on any decision to use the television medium for CHAT. Regardless of some of the obvious advantages of television, which will be discussed in other sections, the fact that the stations would be required to remain on the air for the additional hours might preclude their participation in this program in anything except a nonvoluntary fashion. On the other hand, radio has relatively wide coverage on a 24-hour basis from stations serving the major population centers.

Coverage Summary

For the most part media coverage can be considered independently of the five CHAT modes. The one exception might be the deterioration in secondary coverage expected to occur with any of the modes requiring lowered modulation levels for radio. This disadvantage, however, can probably be overcome either by adding existing stations to fill coverage gaps or, as discussed in Appendix A, by having all radio stations reduce their modulation levels during the operational period. The primary impact of coverage losses due to lower modulation

modes of CHAT will come from public resistance to bad reception in fringe areas. This aspect of the problem is covered in following sections and also Appendix A.

In summary, either AM radio or VHF television, because of the home saturation they provide, could serve CHAT program needs. The coverage afforded by these media has relevance to the total system goal of providing nationwide alerting and warning, as well as to the conditions unique to particular regions or communities. Since whatever advantages are gained from specifying a single medium for participation in the program seem diminished by the flexibility and responsiveness to local conditions gained from a less rigid approach, it is concluded that utilization of a mix of both media will provide the best system coverage. Such a mixture can take full advantage of existing regional variations in media penetration. Further, a mixed-media approach to CHAT would allow taking advantage of the good coverage provided in some areas by FM radio and UHF television, as well as the more popular AM and VHF media.

III. TECHNICAL PROBLEMS

Technical problems related to CHAT operation are considered more fully as a part of the general discussion contained in the appendices, and are only briefly considered here.

A. Obtaining the Warning Message

One problem associated with the participation of a large number of radio and television broadcasting stations is that of providing them with a warning message should the need arise to use CHAT. As discussed in Appendix C, we envision that CHAT would become an adjunct to the Emergency Broadcast System (EBS), and as such become a part of the EBS plans. The Emergency Action Notification System (EANS) could then be used to provide participating CHAT stations with appropriate and properly authenticated warning messages over existing terminals of the AP/UPI wire networks.

Inasmuch as there is likely to be a mix of AM radio and VHF television under the CHAT program, it will be necessary to revise EAN/EBS procedures to allow CHAT participants to broadcast the alerting signal and warning message (these may be pretaped) and then either continue broadcasting EBS data if they are a part of the EBS system, or cease broadcasting if they are not. Some questions that seem to require consideration are:

1. Can CHAT be operated independently of, and under different initiating authority than, EBS?

2. What revisions to EAN system operations or procedures need to be made to provide CHAT participants with properly authenticated warning messages?

3. To what extent should NAWAS be used either as a primary or secondary source of warning information for stations participating in CHAT?

4. Can local outdoor warning system activation be timed to coincide with and complement CHAT operation?

5. Will broadcast stations be willing and should they be allowed to use pretaped warning messages with alerting signals, or should they act only in a relay capacity by broadcasting the contents of the hard copy data received over the wire networks.

B. Decreasing Modulation

The act of decreasing modulation of the audio signal is more a procedural consideration than a technical problem. At most it may require minor changes to circuitry in some instances. However, broadcasting at lowered modulation levels will require revisions or amendment of FCC requirements and modulation standards.

There are two problems requiring solutions when only the stations participating in CHAT decrease modulation. One of these is to determine the extent of adjacent and

co-channel interference caused by reduction of a particular station's modulation. Another is to determine what population coverage reductions will result from reduced modulation. In all likelihood, solutions to these problems will have to be worked out on a station-by-station basis. This could entail field testing the signal loss at low modulation, monitoring the frequency for interference, and calculating new population coverage figures for the station.

It will not be possible to make specific recommendations in this area until more definitive data are obtained about coverage loss and interference problems. The alternatives are: only stations participating in CHAT may lower modulation; all stations may reduce modulation; only stations for which interference is not a problem may be selected.

C. Effects of Modulation Increases

As indicated in Appendix B, the results of the earlier CHAT tests to determine awakening potential of modulation increases were inconclusive. Reviewing the results of the tests and the conditions under which they were administered, we feel that more research in this area is required. In the final analysis, the listener may be the sole determiner as to whether he will be awakened or not, depending upon how high a volume setting on his home receiver he can tolerate and still get to sleep. If he turns the volume low enough to preclude sleep interference, he may have set it too low to be an effective awakener when full modulation is applied. On the other hand, the tendency may well be to leave the volume relatively high; then the listener may either be unable to go to sleep, or he may be awakened by distinctive features of the station program material. It is apparent that more investigation should be carried out in this area.

D. Summary

There appear to be no technical problems that would conclusively rule out any of the media for CHAT operations. Where such problems tend to reduce actual effectiveness, as when co-channel interference lowers coverage in secondary

coverage areas, solutions are readily available. Whether a particular solution should be to select a diffe.nt mode of operation, e.g., Mode 5, Listener Watch, or to modify broadcasting r.'es during crisis peric remains open until further data can be obtained on the practicality of both.

The technical advantages of increased alerting capability from the lowered modulation modes of operation (1-4) provide a clear-cut basis for preferring any one of these to a normal modulation mode. That is, since the lowered modulation modes provide the listener with a chance to sleep with the knowledge that he may be awakened by an alerting signal broadcast at a loud volume, they do appear superior to a mode requiring a family member to remain awake all night. With this as a technical advantage, it is possible to order the modes according to the apparent alerting capability each possesses. Thus, Mode 4 with an unmodulated signal would be ranked first, Modes 3 (Special Signal), 2 (Special Programming), and 1 (Normal Programming) following with little to separate them except program material distinctions; Mode 5 (listener watch) would be ranked last.

IV. PUBLIC ACCEPTANCE

The selection of a particular medium for CHAT, and the selection of one or several of the five described CHAT modes, is largely det rmined and affected by public acceptance. Among the public's requirements for a system such as CHAT, several stand out:

- Simple - The technique should be simple enough so that the user is not required to learn a completely new operating procedure. Public instructions should not be complicated or use unknown terms.

- Effective - The technique should provide sufficient increase in sound intensity level to awaken most of the sleeping population most of the time. During the non-alerting phase, people should be allowed to fall asleep and remain sleeping without interruption.

- Useful - For public support and acceptance, CHAT should not be limited in application to war-caused disasters. There is a real need for night-time alerting and warning for hurricanes, tornadoes, and other natural disasters.

- Dependable - The technique should not be inherently susceptible to false alarms.

In reviewing the operating characteristics of the five proposed modes for CHAT operation, certain features of each stand out as being more conducive to acceptance by the general listening public. Fundamental to the evaluation of acceptance, however, is the assumption that the listening audience will be really concerned about the crisis situation.

It is reasonable to believe that if the listening public is actively concerned during this period it will be more willing to undergo certain inconveniences and changes in its normal mode of living in order to take advantage of the CHAT warning service. This willingness to be inconvenienced is crucial, for CHAT operations are heavily laden with listener responsibility to make the system effective. For CHAT to work at all, the listener will need to understand the seriousness of the situation and be willing to participate during the evening hours--perhaps for an unknown number of nights.

While there are differences among modes in cost of operation and some problems of implementation, e.g., the use of special signals or special programming materials, the primary differences have to do with the acceptance or rejection by the listener of the unique features of each mode.

When we consider how the listener might respond to the various modes of CHAT operation, much of our thinking must necessarily be based upon conjecture.

Discussions were held with a number of persons regarding their acceptance of the features offered in the various CHAT modes. A small survey was conducted and a literature search made, all in an effort to accumulate data that could be useful to this part of the analysis. While individual differences do exist, certain similarities and desirable features can be identified and will be discussed. Further data can be found in Appendix B .

A. Radio CHAT

A quiet receiver is considered to be the most desirable monitoring mode because of the nighttime operation and because radio sets are likely to be located in the bedroom. The no-sound mode (Mode Four) would be the most conducive to sleep and the least likely to instill resistance over several nights of operation on the part of the listening audience. However--though no-sound is a desirable sleeping feature--for purposes of radio set volume adjustment, tuning, confidence and reliability, a mode conveying some signal or tone (Mode Three) that would allow these considerations to be taken care of while still allowing an individual to go to sleep would be the best.

It may well be that a special signal or special musical programming without commercial broadcasts (Mode Two) offers the best mode from the standpoint of relaxing the listener, and allowing him to sleep. In light of the given assumptions, normal programming (Mode One) does not appear as good as no modulation, special signal, or special programming. All of those participating in the discussions and the sample survey felt that listener watch (Mode Five) had the least to offer and would be the least acceptable from the public standpoint. While the listener watch mode does not offer many intrinsic advantages, it is reasonable to assume, because it requires no modulation reductions, that it represents the mode of operation that may have the greatest possibility of being immediately implemented. If the crisis situation is severe enough, and enough of the people are made aware of the seriousness by competent and recognized authorities, this mode has the immediate ability to provide significant coverage potential.

While no audio modulation (Mode Four) is most conducive to sleep, it poses major problems of tuning in radio stations and adjusting volume levels. The listener cannot be assured of the reliability of his set, his tuning, or of the station's operation. These factors indicate that some programming is necessary. Research should indicate which of the three, i.e., normal programming, special signal, or special musical programming, would have the greatest acceptance by the public.

With respect to radio, therefore, and for the aforementioned reasons, the various CHAT modes rank as follows:

Acceptable: Special Signal (Mode Three) or Special Programming (Mode Two) at reduced modulation.

Not Acceptable: No Audio Modulation (Mode Four)

Alternatives with lesser acceptability: Normal Programming (Mode One) with reduced modulation; Listener Watch with full modulation (Mode Five).

B. Television

From the public acceptance standpoint, the use of television (particularly VHF television) ranks highly. The advantages are that the listener-viewer can easily select and tune the station and can be given visual assurance that the station is indeed participating in CHAT and that audio broadcasting will be returned should the need arise. Because of the detent tuning of VHF TV, special audio signals and programming are not required and the listener may adjust his volume control as high as background noise levels will permit. At high-volume control settings, sound level increases under full modulation conditions are expected to be significantly higher than would occur under a reduced modulation condition only. Like radio, UHF TV would probably require some audio programming for the user to insure correct station tuning. From the television listener acceptance standpoint, therefore, the various modes of CHAT rank as follows:

Acceptable: No Audio Modulation (Mode Four)

Alternatives with lesser acceptability: Special Signal (Mode Three) or Special Programming (Mode Two) at reduced modulation; Normal Programming with reduced modulation (Mode One); Listener Watch with full modulation (Mode Five).

V. OPERATIONAL COSTS

Determination of the costs associated with CHAT operation was not a required part of this analysis; nonetheless, some attempt was made to measure costs related to the implementation and operation of the program.

CHAT costs for either television or radio were considered with respect to the following factors:

1. Equipment modifications
2. Radio - Station operating and loss revenue costs
3. Television - Station operating and loss revenue costs.

A. Equipment Modifications

The equipment costs for implementing the CHAT concept would be those associated with obtaining the necessary capability to receive warning messages and those associated with modifications of presently owned broadcasting equipments to provide for sustained periods of operation at low levels of modulation. Discussions held with a variety of people in the industry,[1] and with those knowledgeable in the equipment field, all tended to indicate that these costs are relatively insignificant.

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1. During the course of the project, discussions were held with 14 individuals directly involved with the broadcasting industry, including station managers, station engineers, and engineering consultants.

It is assumed that any station in a large metropolitan area participating in this program would already have either AP or UPI wire service installed. Because of the probable short warning time, it will be necessary that any participating station be able to receive the warning message over one of these wire services and put either it or a pretaped warning message on the air within seconds of its receipt.

In most cases, varying the audio modulation requires only minor adjustments at the studio or transmitter. Station engineers usually can circumvent the need for any special equipment to maintain modulation levels. If special equipment is required, such as bypassing circuitry and switches or an attenuating pad, it should run less than $100 per station.

B. Radio Station Operating and Loss Revenue Costs

1. Operating Costs

The cost to AM Radio Stations for CHAT Operations will vary depending on the mode of CHAT. The use of the normal programming mode (Mode One) with reduced modulation on AM radio should not bring about any significant costs. Because of lower modulation, some loss of broadcast coverage may occur in fringe areas, but this is not seen as a major cause of the loss of station revenue. If, however, we were to assume a mode of operations in which normal programming ceases and special programming occurs, the loss of revenue from advertisers would be a major factor to be considered.

Radio stations selected to be a part of the CHAT system will be those already on a 24-hour operating schedule. The main "cost" will then be from lost revenue, not from special operating costs.

In any of the special programming modes, (Modes Two, Three, and Four) talent fees normally spent for nighttime shows would be reduced or eliminated during CHAT operational periods. Using these modes, most CHAT program materials could be on tape, thus eliminating the need for

special effects, productions, etc., that go to make up the talent category. Talent charges are lower at night because of lower demand for sophisticated programming in these hours.

2. Loss Revenue Costs

Using revenue figures for 1965, Table 4 shows the expected costs of discontinuing commercial broadcasting for radio CHAT. (Although these values are based on real station revenues, industry revenue is subject to normal variations, and these general figures may be rather conservative.)

A range of from $20 to $300 per eight-hour night is given as a fair approximation of the cost per station to operate CHAT.

TABLE 4
Radio CHAT Costs[1] Per 8 Hour Night
Attributed to Revenue Loss

	High Revenue Stations	Average Revenue	Low Revenue
Daily Revenue	$2885	$600	$187
Probable Revenue Losses (25% of daily)	721	150	47
Probable Revenue Recovered			
(1) Make up (55.55%)	400	83	26
(2) Nonpayment of Royalties & talent costs (3.%)	22	5	1
Per Station Costs - 8 hours	$299	$62	$20

1. Based on FCC financial data, for the total yearly broadcast revenues. No estimate is made for personnel reductions or for news, as the amount saved (if any) will vary with the individual station.

C. Television-Station Operating and Loss Revenue Costs

1. Operating Costs

Several factors operating interactively will influence the cost of CHAT operation in the television medium. Principal among these will be the necessity of maintaining a sufficient number of stations on the air during the 11:00 PM to 7:00 AM time period. Unlike radio, relatively few television stations are on the air 24 hours a day. The decided advantage of television lies in the ability of the public to select and identify participating stations easily. Using Mode Four CHAT, television also provides for a probable higher awakening potential through higher volume control setting during the activation period. Unfortunately, providing these advantages to the major metropolitan centers means that stations not normally on the air during the early hours will be required to be on the air, yet will not or should not be able to broadcast if they are to achieve maximum awakening potential.

In view of the relatively few television stations on the air during the early morning hours (as noted above, only seven 24-hour stations were found in a scan of available materials), the stations will have additional expenses as a result of operating the extra hours.

Station operating costs also vary significantly, and precise data about these costs are difficult to obtain. Data were obtained that provide a reasonable estimate of the direct cost per hour to maintain a television station on the air, independent of any broadcast-related costs such as talent, film production, etc The data used were obtained from two sources. Some data were obtained from discussions with technical and operating personnel from several television stations. Unfortunately, these data do not clearly indicate what is included under operating costs, and therefore it is difficult to know how comprehensive the estimate really is. We assume that the values reflect only the salaries of the studio and transmitter staffs and not the indirect costs associated with station operations. The data obtained during the course of the interviews are summarized in Table 5 below.

TABLE 5
Television Station Direct Operating Costs

STATION	STUDIO OPERATING COSTS	TRANSMITTER OPERATIONS	PER HOUR OPERATING COST	PER NIGHT (8 HOURS)
Commercial	$200 hr.	$33 hr.	$233	$1,864
Educational	$225		225	1,800

Another source of data was an FCC document published in 1966, which listed principal expense items of TV stations with time sales of $25,000. Expenses were broken down by salaries and wages, film, talent, and depreciation. Using the data contained in this document, we summed the items of salaries and wages and depreciation and excluded film and talent costs. The total, which was already an average for stations reporting, was then divided by 365 and then by 18 to determine a per hour cost. These data are reflected in Table 6. The figures have been extrapolated to provide a per night cost of 149 stations operating for an eight-hour period.

TABLE 6
Television Operating Expenses Reported to FCC

OPERATING EXPENSES	PER HOUR (BASED ON 18 HOURS)	PER NIGHT (8 HOURS)	NO. STATIONS		
2,278,490	346	2768	x 32	=	88,576
1,514,314	230	1840	x 18	=	33,120
1,131,541	172	1376	x 22	=	30,272
1,053,055	160	1280	x 39	=	49,920
853,912	127	1016	x 38	=	38,608
			149		240,496

NOTE: It is difficult to make operating cost comparisons because of the different considerations that may enter into such an analysis and the reluctance on the part of individual stations to disclose figures.

The use of nonprofit television stations for sources of CHAT broadcasting in some 40 market areas could alleviate any possible financial burden on the commercial stations in those areas. Where such a station meets the operational requirements, it may be a better selection for CHAT from a cost standpoint than a commercial station would be. Data obtained from a community TV station in Los Angeles indicate that the station could be operated for $225 per hour.[1] The limited broadcast schedule of many ETV stations will necessarily reduce the amount of CHAT participation from this source. Only 75 of the 95 ETV stations responding to a Carnegie Commission on Educational Television survey could be expected to be available for a full 52 weeks per year.[2] Eighty-one of the 95 have limited usefulness because they broadcast for six or fewer days during the weeks they are on the air.

2. Revenue Loss Costs

The most striking characteristic of the television industry is the cost involved in its operations. For example, in 1965, before taxes, the television industry grossed almost $2 billion.[3] Most of this revenue was from the sale of time, with the remainder for talent charges, production charges, etc. Since television CHAT Mode Four would operate without the benefit of special talent or elaborate productions, the area of concern is time sales, and the expected impact that CHAT might have on such revenue.

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1. Interview with Chief Engineer, KCET, Los Angeles.

2. Based on Carnegie Commission, Public Television, Bantam Books, 1967, Table 2, p. 142.

3. The exact figure was $1,964,800,000. (FCC, TV Broadcast Financial Data-1965, 2 August 1966, Table 1, B).

The broadcast industry predicates time charges on the basis of audience size reached, and "cost per thousand" is a common unit of measure. There is a wide range of prices that stations ask of commercial sponsors for advertising time, since stations in smaller markets have smaller audiences than those in major market areas. The most extreme examples are to be found in rural areas, where charges may be as low as $150 per hour, and in urban concentrations, where the major stations charge in excess of $10,00 per hour.[1]

All television time is not equally valuable. Audience size varies according to the time of day, and viewer peaks occur between 6:00 and 11:00 PM. Hours are significantly less costly when the audience is smaller, and when audience size recedes too far, most stations go off the air. Since the CHAT operational period begins after the peak viewing hours, losses in revenue will be proportionally less. Rates vary, but Class C time is usually one-half to one-third the cost of Class A (prime) time. Further, the number of class A-C hours lost to CHAT operations will be minimal--on the average, between two and three hours per night.

Using actual broadcast revenue data from 1965 as reported by the FCC, the average hourly station revenue was computed using an 18-hour period as a basis. For example, in New York, six television stations reported a total broadcast revenue of $111,125,954. This amounted to $18,521,000 for an average of the six reporting stations. Dividing this by days in the year and by the average of 18 hours per operating day, the average hourly station revenue from the New York Market area was calculated to be $2,819. The same was done for the Chicago and Los Angeles Market areas. In addition, the average hourly revenue for the top 102 markets was also calculated

1. Prime viewing time charges, without including production or talent charges, are listed in Television Factbook, Stations Volume; 1968-69 Edition, Television Digest, Inc., Washington, D.C.

and, to show the reduced revenue of smaller market areas, hourly revenues for the 168 market areas with less than three stations were found. Finally, all 270 market areas were used to determine a nationwide average hourly revenue of $309.

We estimated an average of two hours of revenue loss per station based upon a brief scan of the published "sign on - sign off" times of television stations and an assumed activation period for CHAT from 11:00 PM to 7:00 AM.

TABLE 7
Television CHAT Potential Revenue Loss[1]

MARKET	AVERAGE HOURLY STATION REVENUE (18 HRS.)	REVENUE LOSS PER STATION (2 HOURS)
NEW YORK	$2,819	$5,630
CHICAGO	2,040	4,080
LOS ANGELES	1,375	2,750
TOP 102 MARKETS	444	888
168 MARKETS W/LESS THAN 3 STATIONS	101	202
270 MARKETS, THE COMBINED TOTAL OF THE ABOVE	309	618

1. Based on: FCC, TV Broadcast Financial Data-1965, 2 August 1965.

These average lost revenue costs to television stations are quite gross, being based on an average of reported actual revenue, which is in turn averaged over the days of the year and the operating hours of the day. A better method is to determine for each participating station the potential loss in revenue based on the particular station's division of time categories and rate charges. Using this method, several stations were examined to determine what the specific hourly costs were for the various time periods. For example for WNBC in New York the hourly revenue loss is $5,175. Note that this figure is nearly double the average for a New York station contained in Table 7. This is because the average figure in Table 7 does not reflect the actual percentage of time that CHAT would be using the prime time periods where rate charges are quite high.

This consideration of revenue loss for television stations participating in CHAT is relevant if these stations incur a loss of revenue by ceasing aural broadcasts at 11:00 PM. If TV CHAT were to be operated like radio CHAT Mode One, i.e., reduced modulation with normal programming for the hours from 11:00 PM to sign off, then revenue loss probably is not a factor. Doing this, however, would seem to deny TV CHAT its most significant technical advantage, which is increased awakening potential brought about by zero modulation and the ability to maintain high home receiver volume.

The question of whether or not losses in revenue will be experienced by television stations is as yet unresolved. Potentially, it can be demonstrated that the stations will suffer losses. For the stations not to incur any loss will require either a giving up of the revenue by the stations as a public service, (an accepted loss) or some payment to them for revenue lost as a result of participating in CHAT. At this time we do not feel in a position to do other than point out that CHAT operations for television will require some deviations from normal operation--

considerably more so than for radio, if the system is to be effective--and that such deviations are likely to be associated with loss in revenue.

D. Summary

Normal cost/effectiveness analyses focus on the trade-offs between increasing costs and increasing effectiveness, seeking a point or points at which the relationship between the two is optimized. To accomplish such an analysis, however, requires that accurate data be available on increases or decreases in effectiveness resulting from changes to the system and that factors external to the system either not influence effectiveness or be held constant in some fashion. CHAT has not been tested in such a way as to allow definitive statements about the effectiveness changes engendered by different modes of operation. The best that can be done is to assess each mode intuitively against what appears to be its relative effectiveness from a listener's perspective.

Industry costs are largely indirect, taking the form of revenues not earned by the broadcaster rather than expenses or charges incurred in the performance of the CHAT functions. The direct costs, particularly to participating stations operating beyond normal broadcasting hours, are salaries, power, phone bills, etc., resulting from the extended operations. Broadcasters' costs tend to increase as the mode of operation offers more to the listeners in the way of convenience, ease of operation, and higher levels of control over sleeping and awakening.

Mode 5, Listener Watch, which offers the least to the listeners and would consequently be the least effective in operation, can be operated for next to nothing (unless the station remains on the air past its usual sign-off time). Mode 1, Normal Programming, is also low cost and does give the listener more convenience in that set volume can be low during the night and will get louder in an emergency, but whether a large proportion of the population can sleep through the normal programming of stations is problematic. It is also possible

that the increased co-channel and adjacent channel interference in fringe areas may cause advertisers to question station charges. In that case, costs for Mode 1 would be somewhat higher than for Mode 5. Modes 2 and 3, while about equally convenient and effective from the listener's standpoint, are both quite expensive in terms of indirect broadcaster costs since both eliminate any commercials during the operational period.

There are certain factors that could militate against assigning too high a priority to "cost" in the determination of the best operational CHAT mode. First, the costs described will only be incurred in the event of a crisis severe enough to cause the system to be activated. It may be difficult to justify an "economy" version of CHAT to a frightened population in the face of high industry salaries and profits. Secondly, it appears that public and congressional attention is more and more being drawn to industry's responsibility to the public and the consumer.[1] The fact that the broadcasting industry uses public airwaves to its own profit, with a license vested in the public interest, could result in a rather negative response toward the broadcasting industry by a public believing that cost had been put ahead of effective warning during a crisis.

1. Note congressional and public concern with auto safety standards, smog emmission, honesty in packaging, truth in lending, etc.

APPENDIX A

SELECTION OF CHAT STATIONS

I. INTRODUCTION

The process of selecting stations to participate in CHAT is one of matching program requirements to the capabilities of the candidate stations. Specific program requirements should be determined by government agencies acting jointly to meet public needs and their own agency obligations. A "candidate station" is any station broadcasting to the public, with a federally granted license, that is determined to be capable of performing the necessary CHAT operations and has the desired coverage.

There is at present no policy that defines the relationships that should exist among the agencies involved in the implementation and operation of CHAT. It is therefore assumed that the FCC will provide technical control and policy, and that OCD will provide basic operational guidance and appropriate field support.

Cooperation among these agencies is necessary to accomplish the station selection and program implementation phase. At the outset, OCD and FCC should map-out estimates of the number of stations required to provide adequate coverage. Guidelines establishing the relative importance of each major factor in the selection of participating stations should also be agreed upon by the agencies.

The EBS plan should be modified to include procedures and authorities applicable to CHAT, and FCC policy should encourage qualified stations to volunteer as participants. As volunteers are obtained, OCD and FCC field representatives should work closely together in determining which station or stations in an area are best qualified.

The following sections delineate the more important variables affecting abilities of the AM radio and television industries to meet the mutual requirements of the public and government.

II. STATION CAPABILITIES

The first condition to satisfy in station selection is the ability of the candidate station to perform the tasks associated with CHAT operation. There should be adequate personnel to staff the station during CHAT hours of operation, the normal operating schedule of the station should allow for CHAT participation, and adequate communication facilities must be available to ensure that the station is able to receive all CHAT operating orders before and during the crisis period.

CONTROL OF HOME RECEIVER VOLUME BY THE BROADCAST STATION

Compliance with the CHAT principle of operation--reducing home receiver volume to allow users to sleep, and raising it to broadcast an alert--is determined by two factors. First is the type of station being considered. Television stations may switch off all microphones, tapes, etc., for the period in which people are sleeping and switch them on to broadcast an alert when that is required. Radio stations must adjust the modulation level on the audio carrier to reduce receiver volume (while allowing people to tune the station in) during the sleep period and readjust the modulation level to broadcast an alert. A second factor is the equipment used by the station for broadcasting, and whether that equipment will allow CHAT to be effectively operated. Since the type of station--VHF or UHF Television, FM or AM radio--is readily determined, the focus here is on equipment problems likely to be encountered and proposed means of their solution.

The technique proposed for use in controlling the volume output of home UHF television and radio receivers is that of varying audio carrier modulation levels from the station. For many stations this will be easily accomplished

through the use of an existing variable attenuating control located at the studio. Normally, this control is situated near the modulation monitor required by FCC rules, and is used to keep the modulation level within FCC-approved tolerances.[1] Where the attenuating control is not available, it is a fairly simple matter to install one. Further, the device may even provide a predetermined modulation level, such as 10 or 15 percent, if a fixed attenuator is used rather than the variable models.

Some stations have partially automated modulation level control by installing compression-limiter amplifiers and other equipment designed to boost low-level signals and cut high-level signals to maintain a specified average modulation level. For such a station to lower its modulation to the level necessary for CHAT operations, this automatic equipment must be removed from the broadcast system. In most cases this can be done by simply unplugging the unit, changing its preset adjustment, or attaching a jumper cable to bypass the element. The equipment may be a part of the transmitter, in which case the station engineer will have to incorporate bypass circuitry.

It is important that any modification to equipments, if required, be made in advance of actual activation, and that a complete description of the actions required to operate the station in the CHAT mode be posted in an appropriate location.

Lowering carrier modulation levels may have an adverse effect on the station's coverage, particularly in fringe or secondary coverage areas. One way to reduce this effect is by broadcasting program materials at a very high compression level.

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1. FCC, Rules and Regulations, Vol. III, January 1964, Paragraph 73.55. The approved levels for normal broadcasting are between 85 and 100 percent at the loudness peaks.

By using a compression amplifier or materials taped with a compression amplifier, the volume range of the program contents can be held within specified levels, providing a uniform volume output. These compressed sounds may tend to seem "flat," since the normal excursions are suppressed electronically. However, this technique offers advantages both of extended transmission range and of fewer adjustments to the modulation level during the night. To achieve the most consistent effects, certain of the program materials could be pretaped (with compression amplification).

STATION STAFFING FOR CHAT OPERATIONS

A station being considered for CHAT participation should ensure that sufficient personnel are available to sustain CHAT operations. The tasks to be accomplished are such that most stations will find it necessary to have at least two people on hand during the hours of CHAT operation. One person must be technically qualified to operate the broadcasting equipment, and the other must be able to answer calls, monitor the teletypewriter, etc.

Nearly all television stations and AM radio stations have large enough staffs to make up crews for emergency or crisis operations. Fewer than two percent of all reporting television stations have less than five full-time employees, and the median station employs between 46 and 50.[1] Station staffs at AM radio stations, however, tend to be smaller. Nearly ten percent of the AM stations employ fewer than five full-time employees, and the median station employs between 11 and 15.[2] The use of part-time employees is fairly common in the AM radio industry and would be acceptable for CHAT.

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1. Broadcasting Yearbook, 1967, p. A-170.

2. Ibid.

STATION OPERATING SCHEDULE

A successful CHAT operation will depend on selection and use of stations certain to be operating at the time that CHAT is activated. For example, some educational television (ETV) stations operate according to unusual yearly schedules, including vacations at Christmas, Easter, etc. Such schedules might not be evident to one unfamiliar with ETV operations. It will be necessary for stations to be selected on the basis of daily, weekly, and year-round operating schedules. Stations operating sporadically, those likely to be routinely inoperative for a number of consecutive days, and those that go off the air normally at local sunset should not be considered.

COMMUNICATION FACILITIES

Orders to test station facilities, activate the CHAT mode, sound the alert, or terminate CHAT should be delivered to the stations as rapidly as possible. Station response to these orders must also occur with no delay. Stations selected to participate in the CHAT program either must have facilities for receiving urgent messages directly, or have well coordinated agreements with other agencies for having the messages relayed over secondary channels.

The primary means for disseminating CHAT messages should be through the Emergency Action Notification System (EANS) and the facilities of the Associated Press (AP) and United Press International (UPI). Original recipients may further disseminate warning messages to other stations and to the public by effecting the Emergency Broadcast System's (EBS) sequence of audio carrier breaks and 1000 cps tones, followed by broadcasting the special messages.[1] Use of EANS will provide every station in the country that subscribes to the AP/UPI news services with an audible (10 bell) alarm and a printed copy of the

1. FCC, Rules and Regulations, op. cit., Paragraph 73.921.

message. Printed or "hard" copy offers the advantage of reduced possibility of misinterpretation (as contrasted with voice messages) and also tends to be self-validating. An alternate means for providing hard copy to subscribers of that system who lack AP/UPI facilities is through the TWX system.

Voice relay of CHAT messages should be accomplished by EBS broadcasts and through the National Warning System (NAWAS). Participating stations not subscribing to one of the news services or to the TWX system must be equipped with the special EBS tone-activated receivers or maintain a listening watch to monitor another EBS station.[1] Message validation and back-up provisions for ensuring that all stations receive the CHAT orders can be provided in communities with NAWAS warning points by having the messages relayed from there to the stations over commercial phone lines.

III. BROADCAST COVERAGE

The requirement for coverage can be viewed from the perspective of existing broadcast facilities and as a function of the ability of stations to transmit useful alerting signals and warning information. For some years now there have been enough radio stations in the United States to provide service to everyone in the country with a receiver. The quality of service to any particular area, however, depends in part on the power of the transmitter and distance to the receiver, and on the time of day, with nighttime being the best for long distance transmission. Investigators at RCA found that 14.1 percent of the population relied exclusively on clear channel (50 KW, protected frequency) stations at night.[2]

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1. Ibid. Paragraph 73.922 specifically states that: "All broadcast station licenses must install, unless specifically exempt, the necessary equipment to receive Emergency Action Notifications or Terminations by means of radio broadcast messages, and must maintain this equipment in a state of readiness for reception, including arrangements for human listening watch or automatic alarm devices, or both."

2. Siegel, L., Civil Defense Public Alert and Warning by Radio, Interim Report No. 1, Radio Corporation of America, 4 November 1963, p. A-16.

Since 1961, 608 new stations have gone on the air, an average rate of about nine new stations per month.[1] The rates of population increase for the nation and for metropolitan and nonmetropolitan areas are given in Table A-1 to show the number of residents in areas served by clear channel and local radio stations. In the continental U.S., there are almost 26 million residents in areas served exclusively by clear channel stations, and 167 million residents in areas served by local stations.

As will be seen in the discussion of radio transmission and reception characteristics, the effects of reducing AM modulation are not sufficiently well known to predict accurately whether residents depending for warning on a clear channel station operating at reduced modulation could find the station on their receivers, or whether the change from low to high modulation would be sufficient to awaken them.

A number of factors account for the low quality of radio coverage in nonmetropolitan areas. Most significant is the tendency of commercial broadcasting interests to situate themselves in or near a market area. This enhances their earnings because advertisers pay for air time on a "per thousands reached per commercial" basis, but does not raise their operating expenses at a proportional rate. Also, to reduce interference from stations transmitting on the same and adjacent frequencies, many of the larger stations (5 KW and higher) are required by the FCC to reduce power and/or use directional antennas after sundown. For the same reason, nearly half of the AM stations are limited to broadcasting hours between sunrise and sunset.[2]

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1. Television Factbook, 1967 Edition, No. 37, p. 12a.

2. Broadcasting Yearbook, op. cit., p. C-45.

Table A-1. United States Square Miles and Population[1] Relying Solely on Clear Chennel Stations for (AM) Radio Service[2]

	1960	Provisional 1965
Square Miles		
Total U.S.[3]	2,974,735	2,974,735
White Area Total[4]	1,726,293	6
Percent in White Area	58.0%	6
Population		
Total U.S.[3]	177,700,280	192,854,000
White Area Residents[5]	25,106,079	25,967,199
Percent in White Area	14.1%	13.5%

1. 1960 Census and 1965 Provisional Census in Statistical Abstract of the United States, GPO, Washington, 1966

2. Based on Table A-4 in L. Siegel, Civil Defense Public Alert and Warning by Radio, Interim Report No. 1, Radio Corporation of America, New York, 4 November 1963, p. A-16, and adjustments made to 1960 census data according to 1965 provisional census data and average annual increase rates reflected therein. The adjustments were made to the residents in white area by compensating for differential rates of increase in metropolitan and nonmetropolitan areas. This was accomplished by computing the compounded annual increase between 1960-65 for the total U.S. (1.5% average increase, 1.0773% compound increase rate) and for nonmetropolitan areas (0.7% average increase, 1.0353% compound increase rate). The ratio between the two compound figures shows the relative increase in nonmetropolitan areas (96.1%) which are assumed to correspond with part of the white areas.

3. Excludes Alaska and Hawaii.

4. "White areas" are those parts of the U.S. not served by local radio (groundwave) during the night hours. These are typically rural portions of the country, as most metropolitan areas have good groundwave radio service.

5. "White area" residents rely solely upon the sky wave (secondary) service of clear channel stations for their only nighttime (AM) radio listening. As of 1961 and not corrected for stations added after 13 September 1961.

6. Assumed to be equal in 1965 due to unavailability of new information.

RADIO TRANSMISSION AND RECEPTION CHARACTERISTICS

The only technical change required of an AM radio station participating in CHAT would be to reduce audio modulation to as low as 10-20 percent. This reduction in modulation theoretically allows the listener to set the volume of his receiver so that he can sleep and still be awakened by the increased sound level when the station resumes full modulation and broadcasts an alerting signal.

Interference from natural and man-made sources appears to be the only major problem likely to be encountered during CHAT operations. Although interference may exist in various degrees during normal broadcast operations, interference effects will be exaggerated in fringe reception areas during the periods when the CHAT stations are broadcasting at lowered modulation levels, because the audio portion of the signal will be diminished by reduced modulation. The power of the station's carrier signal is not affected, and receivers in fringe areas should be able to detect it although all may not be able to reproduce the audio portion.

In addition to the receivers totally unable to receive CHAT programming with acceptable clarity and freedom from noise, an appreciable number of receivers are likely to receive the signals marginally; thus any co-channel or adjacent channel interference would further decrease the numbers of receivers able to receive CHAT broadcasts in fringe areas and primary coverage areas.

Co-Channel and Adjacent-Channel Interference

Radio waves are subject to electromagnetic interference before they are converted into meaningful sounds by the home receiver. The most serious problem arises from the proliferation of AM broadcast stations in the United States. The AM broadcast band is fixed by the FCC between 535 and 1605 KHz. This band is evenly divided into 107 channels, each 10 KHz wide. These channels are now shared by over 4,000 stations in the United States alone.[1]

1. Television Factbook, op. cit., p. 59a.

The FCC assigns frequencies at the center of a channel and holds the broadcaster responsible for staying within the channel limits during all transmissions. A frequency allocation will not be provided by the FCC if it appears that the station might cause interference to an already licensed station using the same or an adjacent channel. The burden of proof is placed on a license applicant to show that his transmitter will not generate electromagnetic interference within primary and secondary coverage areas of other existing licensees.

The prospective station operator must obtain field strength readings on at least five radials and submit engineering reports on the suitability of his transmitting equipment and antenna layout. In many cases stations that do not cause interference during the daylight hours have to reduce transmitter power, employ directional antennas, or even cease transmitting during the night to avoid interfering with other stations.

The rules created and enforced by the FCC, and the precautions taken by station operators, assume an environment in which all stations are broadcasting at full licensed power with normal modulation being applied to the carrier signal. Experience gained by one broadcast engineer[1] indicates that when modulation is reduced by one station, others in the same and adjacent channels tend to override its signal in marginal coverage areas. In the tests conducted in Baltimore, the same problem was observed by participants trying to receive the signal on their home sets.[2]

If CHAT were activated, using the number of AM stations required to obtain full urban area coverage, co-channel and adjacent channel interference problems would not be severe except in secondary coverage areas. It is to be expected that at lowered modulation levels secondary coverage patterns would be reduced,

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1. Interview with Tom Crosnoe, Chief Engineer, KMPC, Los Angeles, California.

2. WBAL Tests. Note that WBAL was operating at reduced power with a directional antenna.

and a number of fringe area listeners would be lost during CHAT operations. To minimize the effects of co- and adjacent-channel interference, a mandatory reduction of modulation by all stations that normally continue to broadcast at night might be effected during CHAT activation periods. Equal modulation reduction by all stations would reduce inadvertent interference by stations not participating in the CHAT program; however, this would also cause some loss of aural quality to all radio listeners in secondary coverage areas.

Self-Cancellation from Ground and Sky Waves

AM radio interference may stem from sources other than stations transmitting on the same or adjacent frequencies. The means by which radio waves are propagated also causes an interference problem. Propagation of radio waves takes many forms, the most common and important being ground and sky waves.

Ground wave propagation occurs when the vertical components of the radio waves travel directly along the ground from the transmitter to the receiver. Ground wave propagation is useful for relatively short distances--something less than 150 miles for the largest (50 KW) transmitters used for commercial AM radio.

Sky wave propagation occurs when radio waves strike electrified regions of the ionosphere and are reflected downward to receiving antennae. Because ionization at higher altitudes is more persistent and lasts through the night, sky wave propagation can extend radio coverage several times further than ground wave after sundown.

Interaction between ground wave and sky wave can, at irregular times and places, create an interference condition known as selective fading. A second problem is the skip distance effect: depending on the altitude of the reflecting layer of ionized particles and on the angle at which the sky waves strike the layer, the distance from the transmitter at which the reflected sky wave touches down may outreach the maximum usable ground wave signal. This leaves a silent zone of no reception.

Other Interference Factors

There are a number of other factors that may operate to reduce effective coverage of AM radio transmissions.

a. The shielding effect of buildings can cause some attenuation to weak radio signals. The degree to which this phenomenon will be operable depends in large part on the materials used in the construction of the building, and on whether an external antenna is attached to the receiver.

b. Various phenomena cause electrical noise that interferes with radio reception. Among these are thunderstorms, cosmic radiation, and sunspot activity. These random noise conditions all contribute to signal interference, depending on the intensity of the noise as compared to the strength of the radio signal.

c. Man-made electrical noise, such as that from power lines, motors, and other devices emitting electrical radiations, competes with the radio signal for receiver reproduction. These noise conditions are strongest in urban areas.

TELEVISION TRANSMISSION AND RECEPTION

This section discusses the unique features of television and some advantages and disadvantages of television CHAT in respect to requirements of the public, broadcasters, and government.

Several features unique to television make the medium particularly appropriate for CHAT operations. Thus far, however, television has played only a modest role in emergency planning and emergency operations. Because of experience, receiver mobility, and a strong public service orientation, radio has been the predominant medium in these areas.

As with radio, television coverage is a function of the existing broadcast stations, relay facilities, and the electrical/transmission characteristics of the television signal. Since 1946, when wartime restrictions on electronic materials were lifted and mass production of home receivers became possible, the number of television stations has increased from 6 to 785.[1] The first surge in new stations occurred in 1948 to 1953, as the early VHF stations were established. After 1953, growth of UHF stations increased until 1956 when it became obvious that VHF stations held an economic edge in obtaining advertisers. In 1962, Congress passed a requirement that all TV sets shipped in interstate commerce be equipped to receive all UHF channels as well as VHF. These factors have contributed to a steady increase in UHF stations that is still not completed. Increase of VHF facilities, though slowing down after the late 1950's, still shows a regular progression over the years.

The majority of television stations cluster in the highly urbanized areas referred to as "markets" by the FCC, broadcasters, and advertisers. A given market may extend far beyond the geographical confines of the main city; for example, KNBC-TV in Los Angeles is seen each week by over 50 percent of the homes with TV in seven Southern California counties. In all, KNBC programs are seen weekly in 3,674,300 of 3,872,700 TV homes in the 10 southern counties of California, geographically an area in excess of 58,000 square miles.[2]

The fact that television stations are clustered in urban centers ensures fairly good population coverage from the outset. The Bureau of the Census estimated that in 1965 almost 124 million people lived in the 212 standard metropolitan statistical areas in the United States. Thus, participation in the CHAT program by television stations could provide large numbers of people with this alerting and warning service.

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1. Television Factbook, op. cit., p. 57a.

2. Television Factbook, op. cit., p. 76b. Some of this coverage, however, is provided by translator and CATV systems.

Not all of the vast audience claimed for television is reached by direct broadcast from the originating television station. An undetermined number of viewers depend, either wholly or in part, on specialized relay facilities for reception of the television signals. The most common of these facilities are the 2052 television translator stations,[1] next are the nearly 1,500 community antenna television (CATV) systems,[2] followed by approximately 55 satellite and affiliated stations.[3] These facilities are of some significance to the CHAT television mode; specifically they present unique technical problems as well as increased administrative and control difficulties likely to hinder full use of the TV media. As noted, the number of people served by relay facilities is unknown, but it is probably quite small compared to the total population.

TRANSMISSION AND RECEPTION CHARACTERISTICS

An advantage of using television for CHAT is that it is a simple matter for the station to cease aural transmissions while continuing visual programming. Thus, a receiver tuned to the CHAT TV station could be left turned on at night with the volume at a high adjustment level. Warning could be easily accomplished by resuming aural transmission of an alerting signal and warning information. This would engender no costs to the broadcaster or government for equipment changes, and the citizen would have only the expense of keeping the set on, since no receiver modifications would be required. Further, since programming (without sound) will be possible during the operational period, people who were not asleep could follow news events via video displays.

While these features hold for VHF television, UHF television tuners are designed to be continuously variable. The user can select a UHF station, tune in the picture to a very sharp image, and may still not have any sound reproduction.

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1. Television Factbook, No. 38, op. cit., p. 215a.

2. Television Magazine, "The Dimensions of CATV," Broadcasting Publications, Inc., Washington, D.C.; March 1967, p. 1.

3. Television Factbook, 1966, No. 36, Section 6, pp. 3-737; hand-tabulated.

While failing to obtain sound and picture simultaneously is usually no problem when the station is broadcasting normally, there would be no way to adjust the set for sound if the UHF station were silent. A viewer depending on a UHF station for CHAT (one not using audio modulation) would therefore either have to tune the station beforehand while it was still operating normally, or take his chances on tuning it properly without sound to guide him after the station went silent.

CHAT is not expected to be 100 percent effecti[illegible] But use of UHF TV without aural program materials lowers the probable effectiveness rate below acceptable levels. Because of this, UHF stations participating in CHAT should be operated at reduced aural modulation levels in the same fashion as AM radio stations.

Line of Sight

Without the aid of relay facilities, the coverage pattern of a particular television station is determined by whether the sending and receiving antennae are within line of sight of one another, the presence of obstructions such as buildings and mountains, the frequency of the transmitted signal, the power of the transmitter, the design of the transmitting antenna, and the characteristics of the receiver and receiving antenna system. Except under unusual circumstances, transmission of a high-grade television signal is limited to the distance between the transmitting antenna and horizon. For this reason, most stations locate their antennae on the tops of high buildings or mountains, or construct very tall supporting towers.[1] It is possible to arrive at an approximation of a station's range by computing the distance to the radio horizon as a function of the antenna height above the average terrain. The formula is:

$$R = 1.40\sqrt{H}$$

where

R = Range in miles

H = Antenna height

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1. Towers above 1,000 feet are becoming more common, and several are over 1300 feet. (Broadcasting, 29 May 1967, p. 59.)

From this criterion the maximum range for a Grade A signal from a station with its antenna 1,000 feet above the average terrain will be about 45 miles.[1] Lower quality reception will be obtained further out, depending on the terrain and other factors. As the height of the antenna increases, the range of the signal will also increase.

Physical Obstructions

Because of the characteristics of high frequency radio waves, a TV signal may be rather easily blocked by the presence of large buildings, mountains, and other objects. Radio waves thus blocked are frequently reflected back, causing reception problems (such as image ghosts, etc.) for receivers in the path of the reflected signals. Even when the signal is not completely blocked by an obstruction, it will often be severely impaired, causing poor quality reception for an area. An example of such a situation is expected to result for large parts of the New York City area from the 1[illegible]-story World Trade Center building in Manhattan. When completed, it is expected that the Trade Center will impair reception to five or six million households, as it would block signals emanating from the Empire State Building (102 stories high).[2]

The question of station selection and of determining qualifications to participate in CHAT is in the final analysis going to be influenced by an analysis of the station's ability to meet CHAT system requirements without significant loss of revenue, increased operating costs, or loss of listener appeal.

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1. Grade A signal is "Satisfactory service expected at least 90 percent of the time for at least 70 percent of the receiving locations." (Television Factbook, Stations Volume, No. 37, 1967, p. 4-B.)

2. Broadcasting, 29 May 1967, p. 58.

APPENDIX B

CHAT PROGRAM MATERIALS

I. INTRODUCTION

There are two important considerations necessary for CHAT programming. First, during the major part of CHAT operations the audience will be either asleep or trying to sleep. Second, CHAT will use the different broadcast media of AM radio and VHF television. Ramifications of these considerations will have an influence on the choice of program materials for use in the CHAT program.

Since the audience will be composed of persons in various stages of sleep, program materials used during the active and operational phases of CHAT will differ. In the active phase, the materials should be such that listeners will be able to get to sleep and stay asleep. In the operational phase, the materials used should not only awaken listeners but provide them with clear unequivocal warning so that the audience will be able to understand and respond rapidly to the information.

The obvious distinctions between radio and television (sound only, no sound, and picture), and the more subtle technical distinctions within the television medium itself (UHF detent, no UHF variable tuning) make it desirable that the program materials be adapted to these special characteristics. AM radio stations and UHF television stations should broadcast audible program materials during the period to allow those tuning in after the technique has been activated to be certain that they are tuned to a CHAT station and that their receivers are properly adjusted for signal and volume.

VHF stations need not use an audio cue to identify themselves as part of CHAT but (as is also true for UHF stations) should broadcast a video display announcing their role in the program. Television stations offer an additional programming

feature not available to radio, namely the possibility of providing various kinds of visual instructional materials and news items for the benefit of those not sleeping.

The following sections present what is presently known about the kinds of program materials likely to be useful for CHAT. The discussion deals with two topics: 1) nonalerting program materials for the period when CHAT is active but no emergency has presented itself, and 2) the alerting signal and the special messages required for CHAT emergency operations.

II. NONALERTING MATERIALS

The choice of program content during the CHAT Active phase has always been of great concern to those involved in CHAT concept development. In recognition of the broadcasting industry's commitment in the program, the earliest plans were for continuous broadcasting of normal programs, but at the required 10 percent modulation level.[1]

The essential components of programming during the nonalerting period of CHAT operations may be termed "filler" materials and identification materials. The filler materials are those which occupy the time between the start and end of the activation period. Identification materials are messages designed to inform the listener/viewer of the purpose of CHAT and to allow him to make set adjustments when necessary.

In the special programming modes of CHAT (Two and Three) music, or ticking clock sounds would serve as filler materials. These materials should be subdued, reducing the chances of awakening those who are asleep and enhancing the chances

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1. Crisis Home Alert Technique (CHAT): "A Radio Broadcast Alert Technique for a Strategic Alert Period," unnumbered memorandum from the files of OCD, 14 January 1965.

of those trying to fall asleep. Psychological studies indicate that arousal from sleep frequently results from the sleeper responding to an "important" sound--as a baby crying will awaken most mothers. Subdued materials for CHAT use should elicit much less arousal response than either the more exciting "up-tempo" kinds of music or the strident, demanding voice delivery techniques employed at many "rock and roll" stations. In Modes One and Five, normal program materials would be used as filler at reduced and normal modulation levels respectively. The sleep inducing and maintaining qualities of these filler materials will vary with what constitutes "normal" programming for the stations participating in CHAT. Mode 4, being a no audio mode, will not require any special filler materials.

Independent of the CHAT mode being considered, a means of identifying the station as participating will be essential during the operational period. The identification message will serve to correctly identify the purpose of CHAT and, for radio and UHF television listeners (when the mode is one of special programming), the message will allow volume adjustments to be accomplished when tuning in after the initial modulation changes have been made.

The identification message should advise the listener that he is tuned to an EBS/CHAT station and to stay tuned for possible emergency warning information. Broadcasts should be made at gradually increasing intervals, e.g., once every 15 minutes for the first hour after activation, once every half hour for the next hour, and hourly thereafter. An example identification message is presented in Figure B-1. Note that the CHAT technique is identified as "Sleep Alert." This or a similar phrase will have more meaning to the public than the CHAT acronym, which in itself does not communicate the intent of the technique.

The proposed message is not lengthy, and we should assume that most of those looking for a CHAT station will be acquainted with their own roles in its operation. To avoid awakening those asleep, the message should be delivered by an

announcer speaking softly but with calm authority, and the pace at which he delivers the message should be measured--possibly even lower than normal delivery of an important message.

Item	Content	Word Count	Time (Sec.)
1	YOU ARE LISTENING TO THE EMERGENCY BROADCAST SYSTEM "SLEEP ALERT."	10	
2	STAY TUNED FOR A POSSIBLE EMERGENCY WARNING FROM THE UNITED STATES GOVERNMENT.	12	
3	ADJUST YOUR RADIO VOLUME TO A LEVEL AT WHICH YOU CAN SLEEP. THIS STATION WILL RESUME BROADCASTING MORE LOUDLY IF WARNING IS NECESSARY.	23	
4	SEE YOUR NEWSPAPER FOR MORE INFORMATION.	6	
	Total (With #3)	45	25
	Total (Without #3)	22	10

Figure B-1. Example of CHAT Radio Identification Message

The video portion of CHAT operations can be quite straightforward, consisting for the most part of a display panel showing the basic information and instructions needed by the public. As shown in Figure B-2, two different statements are listed in describing the station's operations, one for a VHF station and the other for a UHF station broadcasting at lowered modulation levels. A final statement, announcing the time at which the normal broadcasting will be resumed, is also included.

THIS IS (Call Sign) CHANNEL ___, THE EMERGENCY BROADCAST SYSTEM
SLEEP ALERT STATION FOR THE _____AREA

STAY TUNED FOR A POSSIBLE EMERGENCY WARNING FROM THE
UNITED STATES GOVERNMENT

LATEST WIRE SERVICE NEWS (Optional)

YOU SHOULD ADJUST THE VOLUME OF YOUR TELEVISION SET TO THE HIGHEST LEVEL AT WHICH YOU CAN SLEEP. THIS STATION WILL RESUME AUDIO BROADCASTING IF WARNING IS NECESSARY (VHF Stations). THIS STATION WILL RESUME BROADCASTING MORE LOUDLY IF WARNING IS NECESSARY (UHF Stations). SEE YOUR NEWSPAPERS FOR MORE INFORMATION.

OUR REGULAR PROGRAM SCHEDULE WILL BEGIN AGAIN AT ____ A.M.

Figure B-2. Proposed Display Panel for Television Stations Participating in CHAT

As an optional feature, space may be provided in the proposed display panel for wire service news. Stations able to position their camera, teleprinter, and display panel to obtain good video resolution of the information on the panel as well as the teleprinter output pages may want to provide this service to viewers. Stations not choosing to provide this feature, or unable to do so, could reformat the information for subsequent presentation on the panel.

Display panel size, print styles, etc., should be left to the judgment of participating television stations so as to provide the clearest display to their viewers. Some stations may find it useful to broadcast a split image--one side for CHAT information and the other for direct teleprinter output. Since the number of words in the proposed message may be more than most home receivers can clearly resolve, it may be desirable to display the panel in portions.

III. ALERTING MATERIALS

When CHAT's primary purpose of awakening a sleeping population through a special signal and providing a warning message has been accomplished, the remaining task of communicating essential survival information to the public must be assumed by EBS in its role as the communication link between the government and the population during an emergency.

The CHAT operational environment is circumscribed, in the sense that most users will be at home, and their warning sources will be their radio or television receivers. This situation simplifies the task of selecting an appropriate and effective signal to arouse the sleeping population. It has been assumed that CHAT users will be psychologically attuned to the threat situation, and therefore prepared to respond to the alert signal and that they will be within hearing distance of the signal source. Since home receivers will remain on and tuned to the CHAT station, repetitions of the alert signal should eventually awaken even the heaviest sleepers.

A number of variables may modify the effectiveness of the CHAT alert signal. Among these are: distance between the receiver and the individual to be warned, which determines the effective volume increase that changes in modulation level

can achieve; ambient noise level present in the sleeping area, which affects the relative volume increase necessary to awaken a sleeping person; the person's "depth" of sleep when the alert signal sounds, which affects his ability to respond to the signal; and interference conditions that affect the quality of the broadcast signal at the receiver. Certain of these factors are controllable by CHAT users, particularly if the operating instructions are explicit enough so that users will know how to heighten the effectiveness of CHAT.

Except for the CHAT tests conducted at WBAL, it was not possible to locate any substantive studies of alert signals used over radio or television for the purpose of awakening people. Some research that separately investigates broadcasting signals, arousing sleepers and alert signals is available.

The capability of radio to broadcast a usable alerting signal was only superficially investigated by the WBAL tests and in a laboratory experiment conducted by the firm of Gautney and Jones. Although the WBAL tests were hindered by operational problems, and the Gautney and Jones investigation used only pure tones rather than more sophisticated signals, it was concluded that the CHAT alert principle of using a modulation increase was effective. Between 50 and 75 percent of the WBAL test subjects were awakened,[1] and sound pressure levels of 88 db, up 13 db from 75 db, were achieved at 73 percent modulation in the laboratory studies.[2] No evidence suggested that CHAT television would be less effective than radio, and there is reason to suppose that VHF television would be even more effective (for reasons given in text above).

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1. Kerr, James W., Letter to John Wilner, 14 November 1966.

2. Gautney and Jones, "Report on Sound Level Test Public Alert Broadcast Receivers," Attachment B to Walmer E. Strope, Possibilities of an Interim Compatible Radio Alert Method: CHAT, Unnumbered memorandum to Assistant Director of Civil Defense (Technical Services) from Assistant Director of Civil Defense (Research), 16 April 1964. Sound levels were measured at 10 feet relative to 0.0002 dynes/cm^2 and the modulation levels tested were 15 percent, 80 percent and 73 percent.

Numerous psychological studies on sleep arousal tend also to support the effectiveness of the CHAT alerting principle. Coleman, et al.,[1] studied the ability of male college students between the ages of 19 and 26 years to respond to a 70 db signal while at different sleep levels. The response required of the students was that a switch be turned off upon hearing the signal. Failure to respond within a minute of the signal, was scored as a "no response"; in 106 trials with 20 students, only six "no responses" were observed.

Lentzner and Rechtschaffen[2] report an experiment that sheds some light on the relative sound pressure level increase needed to awaken sleepers. In their study, two male subjects were awakened a total of 136 times over a period of 33 nights. A 500 cps tone was used. If the subject failed to awaken, the tone's intensity was gradually increased from its initial level (the lowest level at which the subject could hear it while awake). At each intensity the tone was sounded for five seconds; after a 10-second wait, if the subject did not respond, the tone was repeated with a five decibel increment over the preceding level. This pattern continued until the subject gave a "wrist tapping" response. The average increases over the waking threshold for the lightest level of sleep were 23 and 10 db for Subjects 1 and 2, respectively. Other levels of sleep required increases of 24 db (level 2), 35 db (level 3), 30 db (level 3), and 31 db (level 4). No information was provided on the lowest sound pressure level at which the subjects could hear the tone while awake.

There is no assurance that the subjects reported in these studies were, in fact, completely awake. There is some evidence in the literature to suggest that subjects can respond to auditory stimuli without otherwise showing conventional

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1. Coleman, Paul D., et al., in Ian Oswald, Sleeping and Waking, Elseview Company, New York, 1962, pp. 43ff.

2. Lentzner, Robert and Allan Rechtschaffen, A Comparison of Auditory Threshold During Dreaming and Non-Dreaming Sleep, paper presented at the Illinois Psychological Assocation by Lentzner, October 1960.

arousal behavior.[1] However, the Lentzner and Rechtschaffen study used readings from an electroencephalograph (EEG) to determine that the subjects were not asleep; it is probably safe to believe that these subjects could have accomplished more complex tasks if that had been required.

The studies suggest that the CHAT alerting signal should provide a substantial increase over the ambient noise level and should be at least 70 db as measured at the ear of the sleeper. Neither requirement is beyond the capabilities of the CHAT technique as presently envisioned.

Research bearing on the selection of a particular alerting signal was conducted by Oyer and Hardick[2] at Michigan State University. Among the studies in their investigation was one using 19 male college students with normal hearing. These subjects participated in a test of awakening effectiveness, using six sounds previously determined to be superior for alerting. Each student slept in a room containing an amplifier-speaker through which the six sounds were broadcast after he had gone to sleep (a situation approximating CHAT). The signals were presented one at a time at 80 db sound pressure level during the night to each subject; subjects were instructed to turn on bedside lamps if awakened and to write down subjective evaluations of the signal's alerting quality. This ensured that subjects had awakened and that they were able to perform tasks requiring judgment. It also provided the investigators with both qualitative and quantitative measures of each signal's effectiveness. The results are presented in Table B-3 below:

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1. Weinberg, L., "Evidence Suggesting the Acquisition of a Simple Discrimination During Sleep," Canadian Journal of Psychology/Review of Canadian Psychology, Vol. 20, 1966, pp. 1-11, and A. M. Granada and J. T. Hammack, "Operant Behavior During Sleep," Science, Vol. 133, 12 May 1966, pp. 1485-1486.

2. Oyer, Herbert J., and Edward J. Hardick, Response of Population to Optimum Warning Signal, Michigan State University, SHSLR163, September 1963, pp. 104-107. The report was accomplished under contract OCD-OS-62-162.

Table B-3. Effectiveness of Selected Alert Signals for Awakening Sleeping Subjects[1]

Mean Subjective Rating	Signal Description[2]	Percent of Time Signal Awakened Subjects	Latency in Seconds
3.66	Missile Alarm	79%	16.33
3.53	Yelper Siren Indoors-Slowed	79%	14.57
3.46	British Air Raid Siren-Speeded	79%	13.43
3.38	Yelper Siren-Speeded	68%	14.14
3.15	Diving Alarm	68%	16.36
3.05	Car Horns R1- and R2-Speeded	95%	16.56

1. Based on Herbert J. Oyer and Edward J. Hardick, Response of Population to Optimum Warning Signal, Michigan State University, SHSLR163, September 1963, pp. 105-106.

2. Ibid, pp. 31-40. The signals were described by the authors as follows:

Missile Alarm was a jump-tone signal alternating between two tones, the lowest of which had greatest energy at 600 cps and the higher had greatest energy at 1500 cps. The jump rate was 6 cps. The spectral analysis curve showed these two frequency centers of high amplitude, but in addition revealed a high frequency harmonic within the one-third octave band centered at 3200 cps. The plot also indicated the presence of energy within adjacent one-third octave bands.

The Yelper Siren was an electronically generated warbled signal having maximal energy in the one-third octave band centered at 800 cps. The rate of warbling was about 4 cps per second for the natural signal.

The Diving Alarm, as specified by the Bureau of Ships was a raucous signal similar to a klaxon horn consisting of approximately 445 cps and 760 cps.

The subjective ratings rank the signal with the highest percentage of successful awakenings at the lowest level. However the range of ratings is so narrow (from 3.66 to 3.05) that there was apparently little perceived differences between any of the signals tested. The latency-in-seconds column specifies the average length of time it took each signal to arouse the sleepers. From a practical standpoint there seems to be very little to suggest that a signal requiring a second or two less than the signal with the greatest latency value would be a significant improvement in alerting effectiveness. In a more sophisticated statistical analysis, the authors found "no differences between sounds in terms of latency of response. Each sound was equally effective as an arousal agent."[1]

The spectral analysis revealed energy peaks in the one-third octave bands centered at 500 cps and 1000 cps, but in addition revealed high energy amplitude in the region--around 2000 cps to 2500 cps. As presented in the experiments it was not a continuous signal, but was heard five times in fifteen seconds.

The British Air Raid Siren was another signal that was consistently rated especially high (the version played back at twice the speed it was recorded at). These sounds were relatively continuous over the fifteen second period. This siren, as used during World War II, had a variable rate of warble from 2-6 seconds per warble.

The Yelper Siren (Indoors) was another extremely effective signal, especially in its 'regular' and 'slowed' states. These signals differed somewhat in quality from the yelpers previously discussed. This group of signals was recorded in a room having hard surfaces which affected quality of the signals. This signal had a very weird quality which undoubtedly affected subject response in such a way as to increase its alerting potential.

The Car Horns (R1 and R2) were obtained from a foreign-made automobile and consisted of two horns operating simultaneously with one a high pitch pulsed horn superimposed over a lower pitched continuous horn. The pulsed horn had a pulse rate of two per second in the 'natural' signal. The two horns cannot be distinguished in the curves pictured, however, the peak response (800 cps) of the 'speeded' signal is that of the pulsed horn. The pulsed signal also peaked in the 5000 cps band. The continuous horn in the 'speeded' signal had primary energy in the one-third octave band centered at 640 cps, 1250 cps, 1600 cps, 3200 cps.

1. Ibid., p. 106.

The only variable that presents a substantial range of effectiveness, from less than 70 percent to as high as 95 percent, was the measure of successful awakening. In this case the Car Horns R1- R2-Speeded are clearly superior (being 16 percent more effective in awakening subjects than the closest two competitors) on the one factor that CHAT is designed to accomplish.

This conclusion was reached earlier by Rosenthal,[1] who notes also that in other experiments conducted by Oyer and Hardick three other factors lent support to the superiority of the Car Horns signal. The first of these was that "this signal was among the best five as subjectively rated in a series of tests involving over 1200 people." Second, it "...was among the top three signals as subjectively rated by a group of 20 laborers; this rating was of the sound in a field of factory noise." Finally, "the signal is highly detectable in ambient noise; it ranks highest of all six alert signals in fields of factory noise, street noise, and speech babble."[2] With the exception of the signal's ability to cut through ambient noise, these additional advantages offer little in the way of improved performance for CHAT. Rosenthal's later argument, however, cites the uniqueness of the signal combined with its neutrality and lack of psychological associations in the minds of the public as key features to recommend the signal for radio warning.[3] In his discussion he notes that most of the other signals tested were similar in quality to those used in a variety of situations to denote anything from factory horns to fire trucks. The Car Horns signal stands alone as a unique sound, subjectively associated with warning in a general sense (i.e., its high frequency pitch and horn quality), but effectively neutral in the specific sense of not having been used for any other purpose. The signal can thus be assigned a specific meaning, the public educated in that meaning, and the signal reserved for the sole application of civil defense warning.

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1. Rosenthal, M. I., Proposed Radio Warning System Alert Signal and Warning Messages, TM-L-1960/030/00 (Draft), System Development Corporation, Santa Monica, California, 30 June 1965, Section 4.2.6, pp. 29-30.

2. Ibid.

3. Ibid., p. 30.

WARNING MESSAGES

Little research has been done on effective warning messages. Most writers on the subject agree that the warning message should possess three qualities: a) the message must be self-authenticating; b) it should make its point in the most meaningful terms possible; c) it should motivate recipients into adaptive behavior. These basic requirements can be broken down into many specialized areas, ranging from an analysis of the psycholinguistic principles of word meaning and behavior to recommendations for delivery style.[1]

Rosenthal's[2] discussion of the characteristics of messages disseminated by the radio warning system seems best suited to our purposes; he states that the requirements for an effective warning message are as follows:

> Official. The message should inform the recipient of the official policy of the warning agency.
>
> Impressive. For the warning not to be taken lightly, the message must attract the audience and impress them with the serious nature of the situation.
>
> Unequivocal. The message should allow no opportunity for misinterpretation or contradiction. Its language should be clear, simple, and to the point.
>
> Personal. The message should directly relate to the experience of the recipient and convince him to take the prescribed protective actions.
>
> Balanced. The message should avoid painting the danger as being one so unsurmountable that nothing can be done for self protection, or as being insignificant and unworthy of taking protective actions against. It must balance the threat with an adaptive means of saving oneself.

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1. Cf., The Warning System Research Support Project: Final Report (Draft), "Message Credibility," TM-L-2870/020/00, System Development Corporation, Santa Monica, California, 30 November 1966, pp. 129-150.

2. Rosenthal, M. I., op. cit., pp. 41-65.

For the CHAT warning message to incorporate these attributes within a brief delivery time, it should combine carefully selected words in an appropriate format for delivery by an announcer who is able to convey additional meanings through his tonal inflections and delivery rate. Selecting such an announcer should be on a subjective basis, through listening to qualified actors and others auditioning the message.

Little is known of the vocal qualities required to communicate the urgency and importance of such a message, but the choice of words and format can be defined as a function of the attributes suggested above. The warning message proposed for CHAT in Figure B-3 is based on the one proposed by Rosenthal for tactical alerting and warning for a nuclear attack.

Item	Content	Word Count	Time (Sec.)
1	(Alert Signal).		40
2	ATTACK--ATTACK.	2	
3	THE UNITED STATES IS UNDER NUCLEAR ATTACK.	7	
4	I REPEAT--THE UNITED STATES IS UNDER NUCLEAR ATTACK.	9	10
5	TAKE SHELTER.	2	
6	TAKE SHELTER IMMEDIATELY.	3	
7	YOU ARE IN DANGER--YOU CAN SAVE YOUR LIFE IF YOU TAKE SHELTER IMMEDIATELY.	14	10
8	THIS IS THE EMERGENCY BROADCAST SYSTEM.	6	3
	Total	43	63

Figure B-3. Proposed CHAT Warning Message

This warning message achieves its official character through inclusion of item eight: the reference to the Emergency Broadcast System. Further emphasis of its official character will come from the manner of its presentation and from the fact of its presentation over CHAT. Use of an alerting signal will also reinforce its official status as will numerous repetitions. Use of items three and seven should lead to a qualitative assessment of the gravity of the message.

The wording of the whole message is designed to prevent an equivocal interpretation of its content. The words require no sophisticated understanding and the sentences are simple and direct.

The personal quality of the message is achieved through the direct statement that "you are in danger--you can save your life" (item seven). Again, the tone of voice in which the statement is made and the use of simple words may help the recipient feel that the warning applies to him, and that he must act to save the lives of his family and himself. Additional reinforcement of this personal quality of the message comes later when the Emergency Broadcast System provides information about the local situation. By that time, hopefully, the listener will have begun moving to shelter.

The statement that "the United States is under nuclear attack" leaves no doubt as to the gravity of the threat, and the specificity of the statement "you can save your life if you take shelter immediately" clearly points to the best means of survival.

The CHAT warning message also uses formatting techniques that underscore the seriousness of the warning.[1] The message is "flagged" both by the alerting signal preceding it, and by use of the phrase "attack--attack." These devices

1. Ibid, pp. 43-44.

draw attention to the message in the same way that a headline does in a newspaper. Additional impact is gained by using "start-stop emphasis" wherever possible, wherein key words of a sentence are placed at its end. If the listener is not paying full attention to the message at all times, the key words serve to return his focus to the message's critical aspects. Redundancy is used in the message deliberately.

There are two types of redundancy built into the proposed CHAT alert and warning message: repetition of important statements within the message, and reiteration of the entire sequence (alerting signal and warning message) over at least a 15-minute period. The purpose of redundancy is to ensure complete dissemination of the contents and meaning of the message. Numerous repetitions will get the message to those who are slow in awakening and to those whose receivers are momentarily subjected to interference. Internal redundancy will add emphasis to the meaning of the message.

It should be noted that because of the great importance of warning messages that additional research is being conducted in this area. The recommendation for a CHAT warning message contained herein is based upon the conclusions reached in previous studies. It is hoped that the current studies in this area will contribute significantly to the improvement of this and other warning messages.

APPENDIX C

STATION OPERATIONS

I. INTRODUCTION

Transition from a normal mode of broadcasting operations to CHAT activation will involve some modifications to stations' procedures and plans. These modifications will occur after a presidential-level decision has been made to activate CHAT and after the notification to all broadcasting stations of CHAT activation. Emergency plans should provide a means for disseminating notice to broadcasters, and for giving each station instructions on how to complete preparations. This "CHAT Active" phase of operations will entail minor procedural changes such as reducing modulation levels, reviewing procedures and CHAT alerting and warning tapes, monitoring AP/UPI teletypewriter machines, and handling telephone traffic.

Changes in procedures will also occur when stations return to a fully modulated broadcasting schedule in the morning, upon termination of the crisis, or when it is necessary to use the system for the broadcast of warning, in the event of an attack on the United States.

For maximum usefulness, CHAT's operations and functions must be understood by both broadcasters and the public. This requires that a period of orientation should precede CHAT use. Orientation is needed to familiarize broadcasters with the procedures and with any special CHAT materials and tapes deemed necessary, and to acquaint the public with the emergency role of the broadcast media. These kinds of orientations are presently being used by the EBS, in periodic system tests and institutional spot announcements to acquaint the public with the emergency role of the broadcast media. For CHAT, what is needed is an extension and expansion of current EBS practices. However, because of CHAT's substantially different operations, exercises of the program should involve

actual reductions of carrier modulation by participating stations and public service announcements detailing the listener's role in the CHAT system.

II. ADVANCE NOTIFICATION

Declaration of a crisis and subsequent activation of CHAT EBS should initiate a set of activities that will avoid unnecessary confusion, delays, and less than full participation by the broadcast industry. Three major factors should be considered in planning for advance notification to the broadcasting stations: 1) the means by which the official activation message will be passed, and alternate sources of notification or additional information that might be available; 2) the actual lead-time required for effectively initiating CHAT; and 3) the determination of appropriate personnel and procedures for emergency staffing of stations during the CHAT operational period.

MESSAGE SOURCES

The most logical source (in that it already exists) for the CHAT activating message would be the Emergency Action Notification System (EANS). This system presently allows the National Warning Center (NWC) at Colorado Springs or Washington Warning Area Control Point (WWACP) to disseminate an EAN message to nearly all of the broadcasting stations in the United States. The EAN message is used to authorize the activation of the EBS by participating stations and the termination of broadcasting (after an appropriate announcement) by nonparticipating stations.

The EANS uses AT&T facilities for its input and control circuits and the radio wire facilities of the AP and UPI to relay the message to the nation's radio and television stations. EAN System seizure of the AP and UPI radio wires has absolute priority over any other traffic.[1] The fact that this system is already

1. Swavely, Donald C., Special Report for the Office of Civil Defense: The Emergency Broadcast System, TM-L-1505/041/00, System Development Corporation, Santa Monica, California, 31 March 1964, p. 25.

established, is tested twice weekly, and disseminates its message in less than five minutes from initiation makes it highly desirable for CHAT purposes.

Broadcasters generally are familiar with the emergency notification function of the EANS, and should have no trouble transferring their knowledge to this new application. At present the EAN System has no provisions for messages other than the alerting message, termination message, and test messages; a new message format would have to be developed for the CHAT activation message and new provisions for a unique CHAT code word to ensure message authenticity, as is current practice for the EAN message.

CHAT activation information might be disseminated by use of a high priority EAN/CHAT message.[1] The message would be input through the usual channels, i.e., a half-duplex, 60 wpm teletypewriter service connecting the NWC and WWACP to the principal news bureaus of the AP and UPI in New York City and Chicago. The major change to EAN System practices would be that the control circuit would not switch AP and UPI facilities automatically to the special EANS configuration. This would allow the CHAT message to be handled on a high priority basis but as part of the normal AP/UPI traffic.

Because of the lead-time involved in activating CHAT, the National Warning System (NAWAS) could be used to advantage as a backup to other CHAT activating message sources. NAWAS is a full-period (24-hour) system of leased telephone lines connecting the NWC to some 893 warning points throughout the country.[2] The warning points are public places such as police and fire stations that are

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1. Note that we are speaking of system activation, i.e., putting reduced modulation procedures into effect, and not of operational use to broadcast warning messages.

2. DOD, OCD Annual Report, 1967, p. 50.

staffed on a 24-hour basis. Operating instructions for NAWAS would have to be amended to include instructions for calling participating local radio and TV stations, and for ensuring that full participation in CHAT is obtained. NAWAS usefulness as a primary CHAT message source for broadcast and TV stations is restricted. NAWAS does not presently terminate at stations; it does not go into every town with a radio station; it does not provide hard-copy messages.

TIMING CONSIDERATIONS

CHAT is subject to a number of operational restrictions unique to warning systems. In part, these stem from the fact that CHAT will be activated as a precaution to a possible emergency, not as a response to an actual disaster. Also, CHAT will operate only on a part-time basis, during the usual sleeping hours.

In all likelihood, some features of CHAT operation will be subject to local modification in light of special circumstances. One foreseeable change will occur when several stations in the same area or locality choose to participate in CHAT. In these cases, working agreements between the stations could be made to enter into CHAT activation at staggered times so as to allow for differing retirement hours among their audiences.

There are a number of points that should be covered in any official announcement regarding CHAT:

1. "Sleep-Alert"[1] is a part of the EBS designed to provide emergency alerting and warning information to the sleeping population of the United States.

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1. The term "Sleep-Alert" is substituted for CHAT in discussions where the public is involved because it seems to better convey the meaning of the technique.

2. Participating radio stations will reduce their sound volume at night.

3. Sleep-Alert television stations will, depending on whether they are VHF (Channels 2-13) or UHF (Channels 14-83), remain silent during the night or reduce their sound volume during the night.

4. Before going to sleep, listeners should adjust the volume of their radio or television sets so that they can hear the station but still fall asleep. Those tuning in a VHF television Sleep-Alert station should turn the volume as high as it will go before normal static and set noise becomes uncomfortably loud.

5. All Sleep-Alert stations will broadcast a high volume alerting signal only when they receive word from the National Warning Center at North American Air Defense (NORAD) Headquarters in Colorado Springs.

6. People should learn the locations of shelters near their homes and should make necessary preparations for evacuating their homes.

7. If no alert is called during the night, stations will resume normal volume levels and programs each morning.

8. When the crisis has passed, the President will terminate the emergency procedure and normal nighttime broadcasting procedures will resume.

Officials should know which local radio and TV stations will participate, their hours of operation, and whether sirens will be used to supplement the warning. They should prepare in advance information on shelter location, emergency supplies, etc.

PRERECORDED INSTRUCTIONS

A concise description of the purpose and listener-required operations of CHAT will be needed; it should be prerecorded so that it can be repeated frequently without errors or changes. Since some of this information will be particular to the area served by the station, the recording should be made from a standard script by one of the station announcers and should contain, as a minimum, the following information:

1. That the President has activated Sleep-Alert.

2. A description of the purpose of Sleep-Alert.

3. Whether the station will participate in the alerting/warning operations.

4. The primary coverage area of the local Sleep-Alert stations and their call letters, frequencies, and/or channel assignments.

5. How Sleep-Alert operates--including:

   a. Receiver adjustment procedures.

   b. Hours of operation.

   c. Demonstration playing of the alerting signal (5-10 seconds) with a discussion of when it will be used.

6. Shelter location instructions.

7. List of shelter supplies.

8. Information on the transition to normal broadcasting.

This announcement should be broadcast immediately after the CHAT activating message is received and should be repeated at frequent intervals.

THE SOUND OF CHAT

One aspect of educating the public to the Crisis Home Alerting Technique is the need for people to hear and know the alerting signal sound, which would precede the warning message. It may seem straightforward enough to announce that a siren sound or 1,000 cps tone will be broadcast to awaken people, but there is some evidence that this might not suffice to awaken even sleepers sensitized to the possibility of an alert.

Psychological studies conducted with animals and humans have shown that most are able to discriminate between familiar sounds and unfamiliar sounds during sleep by awakening to the familiar ones and not to the others.[1] The mechanism is similar to that which allows a mother to awaken to the sound of a baby crying, but not to other noises during the night. Zung and Wilson[2] played a tape recording of familiar and unfamiliar sounds to sleeping subjects and observed equal reactions in their electroencephalograph (EEG) readings for both kinds of sounds. When they promised the subjects extra payment for awakening only to the sound of a telephone ringing or a bagpipe playing, they found a significant difference between the number of times the subjects awoke to the motivating sounds as contrasted to the neutral sounds. "The specificity of the discriminatory ability of the sleeping subject can be further seen when we note that he can discriminate the motivated stimulus of a telephone ringing from those neutral stimuli such as doorbell ringing, door chimes, and clock striking, which are somewhat similar in sound.[3]

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1. Murray, Edward J., Sleep, Dreams and Arousal, Appleton-Century-Crafts, New York, 1965, pp. 148-150.

2. Zung, W. K., and W. P. Wilson, "Response to Auditory Stimulation During Sleep," General Psychiatry, Vol. 4, June 1961, pp. 40-44.

3. Ibid., p. 43.

III. CHAT ACTIVE MODE

Accomplishing a smooth transition from normal broadcasting activities to the CHAT mode requires the implementation of a few procedures that will be essential to making CHAT an effective operational warning program.

Personnel will be required to man the broadcast stations during the period CHAT is scheduled to function and to set and maintain modulation levels.

At the time of CHAT activation, the carrier modulation level should be reduced to the required percentage for each participating station (probably in the 10-20 percent range). The modulation monitor must be checked regularly to ensure that this level is maintained.

From the time the CHAT activating message is first received at the broadcasting station, the news service teleprinter will be a most important piece of equipment, as it is over this facility that an attack warning or cancellation message will be received at most of the broadcast stations in the United States. Thus it is essential to the success of the warning system that the teleprinter be monitored closely.

Messages sent over the facilities of AP and UPI are accompanied by a coded signal that rings the teleprinter bell a specified number of times. The highest priority messages, such as the EAN, activate a 10-bell signal. While this audible alarm should be adequate to alert station personnel, some stations place the teleprinter in an out of the way location to cut down on the clatter and noise generated by its normal operations.[1] Where this has been done, arrangements

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1. Kutchenreuter, Paul H., Chairman, Natural Disaster Warning Survey Group, A Proposed Natural Disaster Warning System (NADWARN), Department of Commerce, 1965, p. 84.

should be made either to move the machine to a more accessible location or to ensure that someone is near it at all times. Stations having only TWX sending and receiving units should make similar arrangements.

Television stations that choose to broadcast teleprinter news material (either directly as printed on the machine or after some editing) will have an easier task, since the image will be visible on station monitors where the output can be monitored.

MONITORING KEY EBS STATIONS

In certain areas CHAT stations may not have access to AP or UPI wire services. In these cases, attention should be paid to monitoring the key EBS station in the area for radio broadcasts of the EAN. The FCC currently requires all broadcast licensees to install and maintain a receiver able to pick up EAN or termination messages broadcast by an EBS station.[1] Often, a receiver is activated by the unique sequence of 1000 cps tones and carrier breaks that precede the transition to EBS. The number of stations so equipped is not known, but every broadcast station in the Los Angeles area has this type of receiver or similar equipment.[2]

OPERATION OF THE SYSTEM

Immediately upon receipt of the EAN, the broadcast station should mount the CHAT alerting signal tape while the EBS announcements are being made at full modulation levels. Following the announcement and carrier break tone sequence,

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1. FCC, Rules and Regulations, Vol. III, January 1964, Paragraph 73.922.

2. Statement by John McKnight, Chief Engineer, KNBC-TV, Burbank, California, in an interview with the author.

the alerting signal tape and accompanying warning message should be broadcast until it ends, or until EBS network programming becomes available. It is essential that the audio carrier be fully modulated while the tape and message are being broadcast.

Conversion to Complete EBS Operations

Upon completion of the CHAT alerting signal tape, all stations should comply with FCC rules covering operation of the Emergency Broadcast System. Stations not authorized to continue broadcasting must go off the air, while those with National Defense Emergency Authorizations will broadcast EBS program materials according to the established priorities.

Return to Normal Schedule

The distinguishing feature of the transition to normal broadcasting in the mornings is the care that should be taken in increasing the modulation level gradually to awaken the audience. It may be assumed that people using CHAT at home will be considerably apprehensive; a sudden, loud awakening at 6:00 or 7:00 AM might be a shock to those who were waiting for an attack warning. This would be especially true for persons who normally do not awaken at an early hour or who experience difficulty in falling asleep at night. For these reasons a 15-minute period of gradually increasing modulation would be worth the effort.

It is also important to note that, for CHAT operations, individual receivers will be tuned to a higher volume level than would be desirable even for a clock radio wake-up arrangement. By the end of the 15 minutes of gradual increase in sound, the late sleepers will have had time to turn their sets off without being unpleasantly jolted out of sound sleep.

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13. ABSTRACT

This report presents the results of analyses made of the Crisis Home Alerting Technique (CHAT). The analyses involved studying the several possible modes of CHAT as they would apply to the major broadcasting media. The investigations centered on the following factors: homes covered, technical and operational problems, public acceptance, and cost.

The background and history of CHAT are described in the report as are the various modes of CHAT operation. Conclusions are presented relating to the most appropriate mode/media relationships and recommendations are given on implementation and further considerations necessary. Three appendices are included describing selection of stations, program materials, and station operations.

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